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OF

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1897.

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LIST OF CONTRIBUTORS.

With reference to the several articles contributed by each.

For Verbal Communications, Announcements, etc., see General Index.

PROCEEDINGS

OF THE

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1897.

JANUARY 5.

Mr. CHARLES MORRIS in the Chair.

Thirty-three persons present.

A paper entitled "A Contribution to the Mammalogy of Northern New Jersey," by Samuel N. Rhoads, was presented for publication.

The Council reported its organization and the appointment of the following Standing Committees to serve during the current year.:—

ON LIBRARY.—Charles P. Perot, Arthur Erwin Brown, Harrison Allen, M. D., Henry C. Chapman, M. D. and Henry A. Pilsbry.

ON PUBLICATIONS.—Thomas Meehan, Charles E. Smith, George H. Horn, M. D., Edw. J. Nolan, M. D. and Henry Skinner, M. D.

ON INSTRUCTION.—Uselma C. Smith, Harrison Allen, M. D., George Vaux, Jr., Newlin Peirce, D. D. S. and Samuel N. Rhoads.

COMMITTEE OF COUNCIL ON BY-LAWS.—Isaac J. Wistar, Theodore D. Rand, William Sellers and Benjamin Tilghman.

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JANUARY 12.

The President, SAMUEL G. DIXON, M. D., in the Chair.

Thirty-seven persons present.

The Affinities of Floridian Miocene Land Snails.—MR. PILSBRY spoke of the Miocene Helices and Bulimi from the Silex-beds of Tampa, Florida, stating that the fauna was of as purely Antillean type as that of the Bahamas to-day. *Helix latebrosa, instrumosa, crusta*, etc., belonging to the *Plagioptycha* section of the genus *Cepolis.* "*Helix*" *haruspica* proved to belong, as Dall had suspected, to the genus *Pleurodonta*, and therein is about equally allied to Cuban, Jamaican and Caribbean forms now existing.

The Bulimiform snails of the Silex-beds numbered some four or five species. They have a reflexed peristome, and a heavy deposit upon the parietal wall, which is most strongly developed toward the posterior angle of the aperture, but is there separated from the posterior termination of the outer lip by a narrow channel, somewhat as in certain European and Asiatic species of *Buliminus*, but entirely different from the structure of the same part of the shell in American *Bulimulidæ.* In a species from the island of Fernando Noronha, however, an identical structure occurs. In fact, this species, the *Bulimus ridleyi* of Smith, is so similar to some of the Miocene forms of the Silex-beds that apart from size they are not readily distinguishable. There can be no reasonable doubt, therefore, that *B. ridleyi* is a living representative of this Miocene group, preserved practically unchanged on the remote island of Fernando Noronha, while the group has been wholly crowded out of existence in the continental faunas.

[redacted]

The deaths, on the 15th inst., of John H. Campbell and Charles H. Banes, members, were announced.

The Gastropod Radula.—MR. PILSBRY spoke of the development and specialization of the radula in streptoneurous Gastropoda, showing that the law of mesometamorphosis, originally based upon orthoneurous forms (*Helicidæ*[1]), is equally applicable to the Prosobranchs. His remarks were illustrated by black-board diagrams and a series of specimens.

JANUARY 26.

The President, SAMUEL G. DIXON, M. D., in the Chair.

Twenty-two persons present.

Charles J. Pennock and Williams Biddle Cadwalader were elected members.

The following were ordered to be printed:—

[1] Guide to the Study of Helices, Man. Conch., ix, p. xiii, (1895).

THE PRIMEVAL OCEAN.

BY CHARLES MORRIS.

In dealing with the conditions of the remote past it is impossible to avoid hypothesis, since exact knowledge is not within our reach. The best that can be done is to support hypothesis, as far as possible, with facts drawn from experimental science. It is only in this way that we can deal with the problem of the Primeval Ocean, by seeking evidence for speculative conception in existing facts. The views which are entertained, for instance, concerning the former greatly heated condition of the earth, which must largely affect any hypothesis concerning the ocean, are mainly speculative. Yet there are so many facts to sustain them that they are generally accepted as well founded; and if we accept the view that the earth has gradually cooled to its present state from a former greatly heated or vaporized condition, certain conclusions concerning the former state of the ocean and atmosphere become inevitable.

At one time, under such circumstances, there could have been no ocean, since all the water of the earth must have existed as atmospheric vapor. Still more remotely, perhaps, no water existed, the [redacted]

sank to 212°, and the earliest ocean must have formed at a much higher temperature.

We have experimental evidence of the boiling point of water under pressure up to a certain limit of temperature. Under a pressure of one atmosphere, as is well known, water boils at 212° F. With increase of pressure the boiling point rises, but not in an equivalent ratio, since the energy of evaporation increases more rapidly than that of pressure. For example, under five atmospheres of pressure water boils at about 300° F.; under fifteen atmospheres it boils at about 400° F.; under twenty-five atmospheres it boils at about 440° F. I have given approximate temperatures, so as to state them in round numbers, the actual temperatures differing slightly from those stated.

It is evident from the figures given, that as the temperature rises the energy of evaporation steadily gains the ascendency over that of pressure. At 300°, one hundred degrees of temperature must be added to produce ten additional atmospheres of pressure. At 400° only forty degrees of temperature are needed for the same result. Experiment has gone no further, and we are not aware at what rate the temperature of the boiling point would increase under higher pressures. But if we may judge from the rapidly accelerated increase of evaporative energy with increase of temperature, it may be that at some point between 600° and 800°, all the waters of the ocean would be converted into vapor and form part of the atmosphere.

At the boiling point of 440°, which yields twenty-five atmospheres of pressure, one-twelfth of the oceanic waters would be converted into vapor, and eleven-twelfths continue as water. A total evaporation of the oceanic waters would produce a pressure of about three hundred atmospheres, or 4,500 pounds on each square inch of surface. The primeval pressure must have been still greater, since much water which has sunk into the earth's crust and forms no part of the present ocean must then have added to the volume of atmospheric vapor. We cannot affirm at what limit of temperature this great pressure would be overcome, but, from the rapid rate of increase in evaporative energy observed between one and twenty-five atmospheres of pressure, it seems not improbable that this limit would be reached, as above said, at some point between 600° and 800°.

At the period in question, when all the ocean was in the air, the enormous pressure must have exerted an important influence

upon the surface conditions of the earth. There may have been then a very active tendency to volcanic or earthquake disturbances, but this tendency must have been held greatly in check by the pressure. This great pressure must also have exerted a vigorous influence in condensing surface and aerial materials, converting vapors into liquids and liquids into solids, and thus have played its part in the formation of a solid crust. Again, the abundant aqueous vapor must have been active in the process of surface cooling, rising in heated winds and conveying heat to the upper air. Finally, as the temperature fell, the pressure of the vapor condensed some of its own material into water. The escape of heat then grew still more rapid, through the aid of evaporating water and falling rain, processes which may have long been incessant.

As the surface cooled, through these and other influences, the conversion of vapor into water went on more rapidly, and the atmospheric pressure steadily decreased. This was probably attended with an increase in surface disturbances, the wave of disturbance growing in height as the pressure diminished. As the solid crust grew thicker and the rocks more rigid from progressive cooling, these seismic disturbances again diminished. There was thus probably a cycle of change, from an originally level and quiescent surface to one of ridges and depressions with great disturbance, and again to one of growing quiescence and gradual reduction of inequalities.

[redacted]

then held in solution by the heated oceanic waters, which, from their large percentage of foreign constituents, may have been almost jelly-like in consistency.

It is impossible to estimate the chemical activity of that period. The high temperature of the waters greatly favored such action, and among the dissolved substances were probably many unoxydized materials, now first freely exposed to the assaults of oxygen. The energy of chemism that ensued was probably greater than had ever before or has ever since existed. In addition to simple oxides, many more complex substances were doubtless formed, and it may be that many of the constituents of the primeval rocks then and thus first came into existence.

The story of chemical activity in the earth is, therefore, very closely connected with that of the ocean. It began, no doubt, in the primeval atmosphere, but reached its culmination in the waters of the ocean. During the early period of the earth chemical inaction must have long prevailed, on account of high temperature and unfavorable physical conditions. Perhaps the principal chemical action of the primeval atmosphere was the combination of oxygen and hydrogen into water vapor. But, on the formation of an ocean of highly heated waters, holding in solution a considerable variety of elementary substances and simple compounds, chemism probably grew active, and in time became very energetic as the waters increased in depth and in the variety and volume of their contents. Many of the complex minerals were very likely then formed, and, being insoluble, were separated from the water and deposited as rock formations. Only when the ocean became, in a measure, freed from its abundance of foreign material, did this activity of inorganic chemistry decrease. It has continued to decrease until the present time, when it has practically ceased to exist, oxidation having reduced nearly all substances to a state of chemical fixity.

It has been succeeded by an era of organic chemical action, which is, at present, in a state of full activity, and promises long to continue so. It began in the early seas, probably after their temperature had diminished to near or below the present boiling point. It gradually replaced inorganic chemism, and has long continued active, at first in the water, and later on the land also. It is now, and has long been, at its maximum activity, the quantity of new material produced in the plant and animal world being annually enormous.

Continued refrigeration must, in time, repress this organic activity and bring it finally to an end, the chemical inertness once due to extreme heat being paralleled by a similar inertness due to extreme cold. The interval between is that of the earth's chemical history. In the history of chemistry we perceive, therefore, two great cycles, an inorganic one, whose principal feature is oxidation, which reached its culmination in the remote past, and an organic one, whose principal feature is deoxidation, which is now at its culminating point.

The question which naturally follows is: When did inorganic activity cease, and organic activity begin, and to what extent is the latter an outgrowth from the former? The reduction of the temperature of the ocean had much to do with this change, inorganic action being probably favored by a high temperature, while organic action may have been impossible in waters much above 212°. These two phases of chemical activity differ strikingly in one particular. Inorganic chemism had a fixed period of duration, beyond which it could not exist. When there remained no more substance in condition to be seized upon by oxygen, this phase of chemical action necesssarily ceased. Organic chemism has no such limitation. It may continue in activity, under favorable conditions of temperature and sunlight, indefinitely, its material being practically inexhaustible. Only decrease in temperature can bring it to an end.

As the waters of the primeval ocean slowly cooled, and inorganic chemism declined in activity, organic chemism probably set in,

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molecules, and there may have been a long-continued process of deoxidation and formation of higher carbon and nitrogen compounds, till true organic matter appeared and the chemistry of life came fairly into play.

I have but one further suggestion to offer. That is, that the conditions favoring the development of organic material were transitory, and no longer exist. If living matter were now swept from the earth, it could not, in any probability, be restored. Its seed conditions have passed away. They could not reappear in water of the temperature of the present ocean and the existing chemical relations of inorganic matter. Organic chemistry emerged from a vitally active stage of inorganic chemistry. It could not well arise from the existing passive stage of inorganic chemistry. Fortunately, conditions favoring the origin of organized matter are no longer needed. Organisms have within themselves the power of inducing new chemical action to an indefinite extent. A plant is a natural organic laboratory, within which new organic material is elaborated from elementary constituents which exist abundantly in air and water. From the plant the animal derives the more complex material it requires. Thus the process goes continually on, and can only be brought to an end by a fall in temperature below the point requisite for organic chemism. How far in the future this will be it is impossible to predict, but the reign of life, which has continued for many millions of years upon the earth, will, in all probability, continue for many millions of years to come.

DESCRIPTIONS OF NEW SOUTH AMERICAN BULIMULI.

BY H. A. PILSBRY.

The species described below have been found during the writer's work on the group in the *Manual of Conchology*. Illustrations of them will appear in due course in that series of monographs.

Bulimulus rushii, gorritiensis and *corumbaënsis* belong to the typical section of the genus, characterized by densely wave-wrinkled apical sculpture. *B. pachys, chrysaloides, glyptocephalus* and *sarcochrous* have separated, straight vertical riblets on the nepionic whorls, much as in the Galapagos group *Næsiotes*, or the northern Mexican and Lower Californian groups.

Bulimulus rushii n. sp.

Shell *umbilicate, globose-ovate*, rather thin but solid, light yellowish. Surface with inconspicuous growth-wrinkles and *extremely fine, close incised spiral striæ*, visible only above the periphery. *Spire very short*, conic, the apex obtuse. Whorls slightly over 6, moderately convex, the suture shallow but well marked. Aperture slightly oblique, ovate, a trifle over half the total length of shell; peristome simple, unexpanded, the columellar margin *broadly dilated*

nepionic whorls shallowly, rather irregularly zig-zag wrinkled in the young, this sculpture lost with age. Whorls 6½, convex, with well impressed sutures.

Aperture ovate, rather wide, brownish inside, varying from slightly to decidedly under half the length of the shell; outer lip regularly arcuate, acute, unexpanded and fragile, columella slightly concave, the columellar margin narrowly reflexed above.

Alt. 20 diam. 10½ mill.; alt. of aperture 9 mill.

Alt. 17½ diam. 8 mill.; alt. of aperture 7 mill.

Alt. 17 diam. 8¾ mill; alt. of aperture 8 mill.

Gorriti Island, Maldonado Bay, Uruguay (Dr. Wm. H. Rush, U. S. N.).

A smaller, thinner, more turreted shell than *B. sporadicus* or its varieties, the whorls more convex, apex blunter, the first whorl being planorboid. The whorls are more convex and more wrinkled than in *B. tenuissimus.*

Bulimulus corumbaensis n. n.

Bulimus amænus Bonnet, Rev. et. Mag. de Zool., 1864, p. 70, pl. 6, f. 2. Not *Bulimus amœnus* Pfr.

The locality given by Bonnet for this species is incorrect. It occurs at Corumbá, province of Matto Grosso, Brazil, where Mr. Herbert H. Smith found it common on walls, etc. *B. corumbaënsis* is closely allied to the typical form of *B. sporadicus* Orb., but it is a less elongated shell, solid, with distinctly expanded peristome and very widely dilated columellar lip, the umbilicus larger than in *sporadicus.* The striped color pattern is a conspicuous but variable character. It belongs to the restricted subgenus *Bulimulus* (+*Leptomerus*).

It may be remarked here that but few of the localities given by Bonnet, for species described in the paper mentioned above, are correct. His *Helix vitrea* is not South American. *Bulimus pictus* is not Peruvian, being a form of *Drymæus pœcilus* Orb. of Bolivia (Province Santa Cruz) and Matto Grosso. *Pupa varius*, said to be Tasmanian, is a mottled race of *Cerion glans*, of New Providence, Bahamas.

Bulimulus angrandianus n. n.

Bulimus radiatus Morelet, Séries Conchyliologiques, III, p. 188, pl. 9, f. 2. Not *Bulimus radiatus* Bruguière.

The name of this Peruvian species of the section *Lissoacme* being preoccupied, may be changed as above.

Bulimulus pachys n. sp.

Shell umbilicate, ovate-conic, solid and strong; surface smoothish, with slight growth-wrinkles, rather regular and close on the spire and disposed to be interrupted. Spire acutely and straightly conic with subhorizontal sutures, the apex small, obtuse, earlier $1\frac{3}{4}$ whorls regularly and rather finely costulate vertically. Whorls $7\frac{1}{2}$, convex; sutures well impressed, the last hardly descending; last whorl regularly convex and inflated.

Aperture subvertical, ovate, somewhat over half the length of shell, white inside; peristome unexpanded, rather blunt, the outer margin regularly arched, columella slightly concave, its margin broadly reflexed, with a salient angle at junction of reflexion with basal lip; parietal callus moderate; umbilicus deep and rounded.

Alt. $32\frac{1}{2}$ diam. 20; alt. of aperture 18 mill.

Province of Bahia, Brazil (v. d. Busch).

The type is a faded, decolored specimen, showing traces of a median white girdle, brown above and slightly so below it, as in *B. durus* Spix. It is considerably like *B. heterotrichus* in size and form, but is unlike that species in the less oblique aperture with blunt, unexpanded outer lip, the differently formed columella and the costulate apical whorls. In general aspect it somewhat resembles Binney's *B. patriarcha.* The columellar lip is pressed in above, unlike that of *B. durus*, which is, besides, a smaller species.

Bulimulus chrysaloides n. sp.

[redacted]

The nepionic whorls, when unworn, show a vertically ribbed sculpture very different from the reticulate apices of the *B. exilis* group, but like the apex of *B. sanctæluciæ* Smith. The peculiar columella also somewhat resembles that species, which in proportions is also quite similar, but the post-nepionic sculpture and dark color of *chrysaloides* are unlike Smith's form.

Bulimulus glyptocephalus n. sp.

Shell narrowly perforated, long ovate, solid and thick, of *chalky texture. White* or bluish-white, *the apical whorl buff*, the next bluish below, pale above. Surface irregularly and coarsely *wrinkle-striate and conspicuously malleated; apical whorl with conspicuous, arcuate riblets*, becoming closer and *beaded on the second whorl.* Spire conic, the *apex very obtuse*, sutures impressed; whorls 5½, weakly convex, the last suture slightly more descending along the latter half, and consequently a trifle oblique to the others.

Aperture a trifle exceeding half the total altitude of shell, subvertical, white inside, with a faint narrow band at position of the periphery and another wide one above; outer lip *blunt, obtuse, not expanded;* columella concave below, straighter above, the columellar margin broadly dilated above, reducing the umbilicus to a chink; parietal callus white, rather thin. Alt. 31, diam. 17 mill.; alt. of aperture 15½ mill.

Peru (A. Agassiz).

A peculiar form unlike any Peruvian species known to me except the next, in the characters of the earlier whorls. It differs from the following species in its elliptical-ovate shape and larger aperture.

Bulimulus sarcochrous n. sp.

Shell narrowly umbilicated, ovate-conic, solid and strong. Fleshy white, becoming flesh-pink and then brownish above, the earlier 2 whorls brown below, white above. Surface irregularly, weakly striate, more wrinkled below the sutures, faintly malleated on the body whorl; apical sculpture as in the preceding species, except that the riblets are less prominent and are much finer and closer on the second whorl. Spire straightly conic, the *apex very obtuse;* whorls 5½, nearly flat, the last one not more rapidly descending than the rest.

Aperture ovate, one-half the altitude of shell, vertical, light brown inside, with a faint, narrow light band at position of the periphery, and white within the lip-edge; *outer lip obtuse* and rather thick, not

expanded; columella with an oblique fold above, the columellar margin well dilated, rounded. Alt. 29, diam. 16 mill.; alt. of aperture 14½ mill.

Peru.

Closely allied to the preceding species, but the spire is more slender, the umbilicus larger, surface less malleated and the columellar fold more conspicuous. The apical riblets are finer and closer, less coarsely granulated on the second whorl.

Drymaeus (Neopetraeus) filiola n. sp.

Shell acutely oblong-ovate, solid and strong. Opaque, whitish, distinctly flesh tinted at apex and last whorl, the spire bluish. Surface shining, very irregularly striated, with scattered short transverse impressions. Whorls fully 6½, the first nearly planorboid above, the second much higher than wide, producing a mamillar apex with the characteristic sculpture of the subgenus. Following whorls of spire flat, acutely keeled, the keel appearing just above sutures, becoming more obtuse and concealed below; next to last whorl convex; last whorl oblong, convex.

Aperture irregularly ovate, purple-brown inside; peristome blunt, hardly expanded, pale edged; columellar margin vertical and straight, parietal wall flesh-colored, with no perceptible callus. Columella very broad above, obliquely truncated in the middle, producing the effect of a large blunt tooth. Umbilicus perforated, with a compressed, long chink behind the inner lip. Length 45, diam.

A CONTRIBUTION TO THE MAMMALOGY OF NORTHERN NEW JERSEY.

BY SAMUEL N. RHOADS.

The following notes on New Jersey mammals are based on personal experience had during three collecting trips in the northern portion of the State. In some cases I have added to my own observations those of people living in the localities named, whose testimony was considered thoroughly reliable.

Trip number one was made during the last week in May, 1893, to Nolan's Point, Lake Hopatcong, Morris County, collecting being confined within a radius of three miles from Nolan's Point Villa, on the east shore of the lake.

The second trip included a brief stay of five days during the last week in August, 1893, at a place near Delaware Gap station in the western corner of Warren County. Trapping was restricted to a line of woodland and meadow connecting a lake (Sunfish Pond) 2 miles distant, with the farm-house in which I lodged near Delaware Gap.

The third and most important trip covered a period of three weeks, extending from the sixth to the thirtieth days of October, 1896. It included three stops of one week each ; the first at Culver's Lake, Sussex County, the second at Unionville, Orange County, New York, just across the northern boundary of Sussex County near the Walkill Valley, and the third at the southern end of Greenwood Lake in Passaic County.

Considered in their faunal, geological and topographic relations, there is a great similarity in all the localities named, lying as they do within the Alleghenian life region, as restricted by Dr. J. A. Allen, and moulded by the powerful agencies of the glacial period which has left its characteristic impress upon the greater part of northern New Jersey. The mountains of Warren, Sussex and Passaic Counties are the highest on the eastern side of the Delaware River, several attaining the height of nearly 1,900 feet. The Kittatinny Range, in its continuation northward from the Water Gap, runs close to two stations named in the above itinerary, viz., Delaware Gap on the western slope and Culver's Lake (Culver's Gap) on the eastern. The mountain at these places is covered mainly with

deciduous trees, alternating with pines and occasional hemlock in swampy localities, isolated bogs of tamarack and rhododendron and fir affording retreat for animals more characteristic of the Canadian fauna.

The lakes of New Jersey are numerous; Culver's Lake and Long Lake together cover a considerable tract, and with their surroundings of swamp and mountain form a natural forest game preserve that is well worth the future attention of the legislators of the State. At Lake Hopatcong, the largest of all, the country is less mountainous, and the fauna and flora shade somewhat into the Carolinian elements, but at Greenwood Lake the western range of Greenwood Mountain shows the most marked Canadian features noted in the State, frequent swamps and bogs of white cedar, fir, pine, hemlock and tamarack nestling among the depressions of the summits.

The excursions of which the following pages form a summary are part of the author's plan to make a comprehensive zoological survey of all the counties of New Jersey and Pennsylvania, with special reference to mammalogy and herpetology. About half of this labor has been completed.

1. **Didelphis marsupialis virginiana** (Kerr). Virginia Opossum.

No specimens of opossum were taken. Its rare occurrence at Greenwood Lake, where I was informed by the hunters that two had been captured in the last two years, is of interest as showing the presence of this animal in the most boreal surroundings, which the

Zimmerman[3] is the first name given to the South American species from Cayenne; *D. aurita* Max. Wied[4] (=*D. azaræ* Temm.) becoming under the ruling of Thomas (lc.), *D. karkinophaga aurita* (Max. Wied).

2. Dorcelaphus virginianus (Bodd.). Virginia Deer.

It has been many years since one of these animals was killed in any of the localities visited. Several are confined in a game preserve surrounding Sunfish Pond in Warren County, and a few in the Dalrymple preserve on the east side of Long Lake in Sussex County.

3. ? Cervus canadensis (Erxl.). Wapiti.

A hunter near Delaware Gap declared that his grandfather, who "killed the last Elk shot in Pike County," Pennsylvania, stated that sometimes the hounds would drive both elk and deer across the Delaware River onto the Kittatinny Mountain. That the latter species has quite recently been known to find temporary refuge in Sussex County on this account is easily proved, and it is probable that in this manner the Wapiti has either voluntarily or involuntarily become a member of the New Jersey fauna within the present century.

4. Lepus americanus Erxl. Varying Hare.

Once pretty numerous in the tamarack swamps of northern New Jersey, this species now seems to be exterminated. Mr. Larkin Hazen stated that he shot one about six winters ago on Greenwood Mountain just across the State line in Orange County, New York. They used to frequent a small swamp near Culver's Gap, but I was unable to find any trace of them there.

5. Lepus sylvaticus Bachm. Wood Hare.

No specimens of this common species were secured. On this account I am unable to say whether the subspecies *transitionalis* is found in northern New Jersey.

6. Synaptomys cooperi Baird. Cooper's Vole.

Four specimens of Cooper's Vole were secured. The first, an adult male, was trapped in a wet meadow close to woodland among sphagnum and tussocks of *Juncus*; and the second, an adult nursing female, under a heap of stones along the edge of dry wood-land but quite near swampy ground. Both these specimens were caught

[3] Geog. Gesch., 1870, p. 226.
[4] Beitr. Nat. Bras., 1826, p. 395.

near the head of Long Lake, adjoining Bear Swamp, October 8th and 15th, 1896. Two additional examples were trapped October 29th at Greenwood Lake, the first in a wet pasture lot at the south end of the lake, the last along a deep ravine in Greenwood Mountain, among sphagnum and grass by the road-side.

In no case have I seen this species out of easy reach of sphagnum or removed a stone's throw from woodland, even when wet meadows afforded it a tempting diversion into open country.

The specimens are esentially like those of this species taken in Pennsylvania and New England, being uniformly lighter colored than those found in the bogs of southern New Jersey at the same season, to which I gave the name *Synaptomys stonei* in 1893, and which a full series of specimens is likely to prove separable from *cooperi* as a subspecies.

I believe the above record of typical *cooperi* is the first for New Jersey, though it is probable that Cooper's original specimen was taken in the northern section of the State.

7. **Microtus pennsylvanicus** (Ord). Wilson's Meadow Vole.

As was expected, the common meadow mouse proved very abundant in all visited localities.

Of the ninety specimens taken, none show any remarkable variation from the typical form found in southeastern Pennsylvania. Several females contained embryos, while young of all stages of growth were secured. It is not likely that the severest winter

sulted to determine this point. In any event, all the Pine Voles of Pennsylvania and New Jersey belong more properly to the northern type.

No specimens were taken except at Delaware Gap.

9. **Evotomys gapperi** (Vigors). Gapper's Wood Vole.

Thirteen specimens were trapped in and about Bear Swamp near Long Lake, and six more in a hemlock swamp in the bottoms of the Walkill about two miles south of the New York State line. They are similar to specimens from Quebec, being lighter colored than those taken by Mr. Stone at May's Landing, New Jersey, in 1893.

I am convinced that the reason this species was not taken near Greenwood Lake, was my neglect to set traps in the more retired and deep-shaded hemlock swamps.

10. **Fiber zibethicus** (L.). Muskrat.

No specimens of this abundant species were taken, except at Lake Hopatcong.

11. **Peromyscus leucopus** (Raf.). Deer Mouse.

A large series of deer mice from every locality mentioned in the itinerary of this paper closely conform in character to those of other parts of New Jersey and Pennsylvania. Though abundant in localities where *Evotomys* was found, no specimens of *P. canadensis* were secured among them, showing that the mountains of northern New Jersey lack the more typical Canadian elements which are found in isolated places in Pennsylvania where I have taken *canadensis.*

There is a marked racial difference between *leucopus* of Pennsylvania and New Jersey and the type of *leucopus* found in Massachusetts and northern New York, the latter being smaller and brighter colored with a narrower dark dorsal stripe and more hairy tail. Pennsylvania and New Jersey specimens are practically identical with those collected by me in west Tennessee and Kentucky, where the type form of *leucopus* defined by Rafinesque is found. It has been proved by Mr. G. S. Miller, Jr.,[6] that the *Cricetus myodes* of Gapper applies to the smaller short-tailed deer mouse of Canada which is apparently identical with those of northern New York and New England. These facts induce me to revive the name *myodes* for the small deer mouse of the eastern Canadian fauna, making it read *Peromyscus leucopus myodes* (Gapper).

[6] Proc. Biol. Soc. Wash., 1893, pp. 59, 60.

12. Neotoma magister Baird. Allegheny Cave Rat.

The occurrence of this rat in the Hudson highlands near New Jersey, and in Massachusetts also, has for some years led mammalogists to believe that its distribution across the intervening country would be found continuous in favorable localities. Save the discovery of their remains in the cave deposits of Monroe County, Pennsylvania, there has been no definite record to my knowledge which would connect their habitat in the Allegheny Mountains with that on the Hudson River. I was informed, however, by a hunter at Delaware Gap, that he knew of such an animal on the Kittatinny Mountain in Warren County. This statement I was unable to verify, owing to my short stay at that place. It is very likely that this rat will also be found on the Kittatinny range near Culver's Gap, but during my visit no exploration of the summits was made.

Soon after my arrival at Greenwood Lake, I was told by a local sportsman that he had once caught a "wood rat" on the mountain in a deadfall set for skunks. The summits of Greenwood Mountain at the south end of the lake are made up exclusively of great masses of glaciated conglomerate and shale with perpendicular fissures and steep faults running parallel with the northeast and southwest trend of the range. Chestnut and scrub oaks and dwarfed pines and hemlocks sparingly cover the nakedness of this desolate but picturesque locality. Owing to their perpendicular cleavage, I found the rocks rarely afforded the proper shelter for the abode of the cliff rat, and [redacted]

swamp grown up with *Juncus* and grasses. The temperature fell on two nights when these were taken to near 32°, forming heavy frosts. Their absence from my traps in the Walkill Valley and at Greenwood Lake was undoubtedly due to the low temperature having driven them all to their winter repose. A thick layer of yellow fat completely covered the bodies of these Culver's Lake specimens, adhering so firmly to the skin that it was very difficult to preserve the specimens.

16. **Zapus insignis** Miller. Woodland Jumping Mouse.

I secured four beautiful specimens of this *Zapus* in woodland along a small rocky stream connecting a rhododendron swamp with Lake Hopatcong, near Nolan's Point. All were trapped close by the water's edge, precisely as described by Mr. Miller in his later account of the species. I have never taken this animal in open situations such as are preferred by its kinsman of the meadow. The most persistent trapping in likely places at Culver's and Greenwood Lakes did not reveal the presence of *insignis* there. It seems probable that it is more sensitive to frost than *hudsonius* and had gone into winter quarters before my arrival at Culver's Lake. At Greenwood Lake a dormant jumping mouse, evidently of this species from the description given me by the finder, was dug out of a gravel bank during my stay. I visited the spot, and from its situation in deep woodland near a brook, I am morally sure it was *insignis*. The narrator of the incident stated that he knew the meadow species very well, but that this one was "much redder." These particulars are given to show not only that *insignis* is found in Passaic County, but to prove that it hibernates earlier than *hudsonius*.

The presence of a persistent premolar in all other known species of the genus as contrasted with its absence in *Zapus insignis* may eventually entitle the latter to separate subgeneric rank.

17. **Castor canadensis** Kuhl. American Beaver.

Numerous localities in northern New Jersey are pointed out as the traditional sites of beaver colonies. This animal was so early exterminated in these places that I found it impossible to secure any data relating to the time of their extinction.

18. **Arctomys monax** (L.). Woodchuck; Ground Hog.

Very abundant on the Delaware slope of the Kittatinny Mountain; less so in other localities named except at Lake Hopatcong. No specimens were taken.

It seems strange that the unmistakable difference in size and color obtaining between the woodchucks of the Hudson Bay regions and those of Maryland, the type locality of *monax*, should not have been officially recognized. With Dr. Allen's excellent analysis of its nomenclature[6] as a basis, I see no objection to designating the woodchucks of eastern North America by the following formulæ :—

1. *Arctomys monax* (Linnæus), Syst. Nat., 1758, p. 60; Maryland Marmot. Size small; color gray-brown, feet brown. Habitat.—Carolinian fauna, intergrading northward through the Alleghenian and Canadian fauna into

2. *Arctomys monax melanopus* (Kuhl), Beitrage, 1820, p. 64; Hudson Bay Marmot. Size large; color brown-black, feet black. Habitat.—Hudsonian fauna, intergrading southward with typical *monax*.

19. Tamias striatus (L.). Carolina Chipmunk.

Forty specimens, representing every locality visited, show nearer affinities to the Carolinian than the Canadian form of our eastern chipmunk. Those from Delaware Gap are scarcely separable from southern New Jersey examples, the Greenwood Lake series being nearest to *lysteri* of Maine, but much darker. This animal is very abundant in Warren, Sussex and Passaic Counties, but not so numerous at Lake Hopatcong.

A temperature of 28° during my stay at Greenwood Lake did not wholly silence them, though it greatly lessened their activity and

22. Sciuropterus volans (L.). Carolinian Flying Squirrel.

A female and three young taken at Lake Hopatcong, and a male from near Culver's Lake, show no tendency to gradation with the northern animal.

23. Procyon lotor (L.). Raccoon.

Not rare. A special object of sport among the natives of Greenwood Lake.

24. Lutra hudsonica Lacép. Canadian Otter.

The otter continues to exist in all the more secluded bodies of water in the counties under consideration. Specimens had been taken at Hopatcong, Culver's and Greenwood Lakes within a year of my visits to these places.

25. Putorius vison lutreocephalus (Harlan). Southeastern Mink.

None of this species were seen. The hunters everywhere reported them scarce.

26. Putorius noveboracensis Emmons. Carolina Weasel.

Not common and rarely becoming white in winter, even at Greenwood Lake.

27. Mephitis mephitica (Shaw). Northern Skunk.

Not having specimens, I am induced to include the skunks of northern New Jersey under the above name, solely on geographical grounds. They are fairly abundant in the region.

28. Ursus americanus Pallas. American Black Bear.

No bears were reported to me as still existing in the localities visited. The recent killing of bears at Port Jervis, makes it possible that they occasionally wander into the northwestern corner of Sussex County.

29. Urocyon cinereoargenteus (Müll.). Northern Gray Fox.

Reported to be rare by hunters. Outnumbering the red species at Lake Hopatcong.

30. Vulpes pennsylvanicus (Bodd.). American Red Fox.

Numerous in the rocky, mountainous districts.

31. Canis nubilus Say. American Timber Wolf.

This destructive animal was exterminated in northern New Jersey so long ago that I could obtain no definite data of its disappearance.

32. Lynx ruffus (Gueldenstaedt).[7] Eastern Bay Lynx.

Not yet exterminated in Sussex and Passaic Counties, but very rarely taken.

I have been unable to get any record of the Canada Lynx for this region, though it probably wandered thither in earlier times.

33. Felis concolor (L.). Puma.

The same remarks which I have previously made regarding the wolf are applicable to this animal.

34. Scalops aquaticus (L.). Carolinian Mole.

Not rare in suitable localities. None were secured.

35. Condylura cristata (L.). Star-nose Mole.

An old female and four nearly mature young were taken in the same trap on successive days in the underground passage-ways of a spring near Nolan's Point, Lake Hopatcong. The wrist and forearms of the female are encircled by a clear buffy band. The throat, breast and median abdominal line are suffused with dark orange.

36. Blarina brevicauda (Say). Northern Mole Shrew.

This *Blarina* is exceedingly abundant in all sorts of situations. In Sussex and Passaic Counties it approaches closely in size to the Canadian specimens.

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[7] The Academy of Natural Sciences of Philadelphia having recently come into possession of the series of "*Novi Commentarii*" of the Imperial Academy of Sciences of St. Petersburg, I am enabled to consult for the first time the

37. **Sorex personatus** Geoff. St. Hil. Masked Shrew.

A specimen of what I suppose to be this shrew was taken at Delaware Gap.

38. **Sorex fumeus** Miller. Smoky Shrew.

One was taken near Culver's Gap, another near Greenwood Lake. True *Sorex* is apparently a great rarity in northern New Jersey.

39. **Vespertilio lucifugus** LeC. Little Brown Bat.

One specimen was taken at Delaware Gap and several seen at other stations. It is the commonest species in these regions.

40. **Adelonycteris fusca** (Pal. de Beauv.). Greater Brown Bat.

An abundant species.

41. **Atalapha borealis** (Müll.). Red Bat.

Several were noted.

OBSERVATIONS ON TARSIUS FUSCUS.

BY HARRISON ALLEN, M. D.

The Academy of Natural Sciences of Philadelphia possesses an adult female of *Tarsius fuscus* which through the courtesy of the curators I have recently dissected. The specimen was purchased of Mr. H. A. Ward of Rochester, and is without locality. I propose to describe the superficies, auricle, rugæ, bones and muscles, and compare them especially with the account of the corresponding parts in the allied species *Tarsius tarsius*, as given in Burmeister's monograph.[1] This memoir, elaborately detailed and beautifully illustrated by the author, stands in such high repute that anatomists have accepted the account of the genus as final. Mivart and Muir in their descriptions of the structure of the Lemuroidea[2] omit *Tarsius*. Nevertheless, I have been induced to make this record because of the specific independence of the Academy's specimen, as well as for the reason that variations in structure should be made the subject of special scrutiny. Apart from these considerations, I believe the warmest admirer of the memoir will admit that the teeth are imperfectly described and the references to the mechanism of the

forearm, the leg and the tarsus as far as the midtarsal line, are covered with sparse short unicolored light gray hair; the face is well covered with short hair, the snout alone being naked. The tail at the basal inch is marked by the same character of hair as the rump. The proportion of plumbeous hair at the base is, however, less. The remaining part of the tail is hairless, except at the terminal three inches where a conspicuous pencillated arrangement of obscure black hair is seen. The flexor surfaces of contact of the thigh and leg are naked, as also are the palms and soles.

REMARKS ON THE SPECIES OF TARSIUS.

Burmeister gives an elaborate synonymy of *T. spectrum*, as denominated by him—the *T. tarsius* of this essay—and refers to and figures a second species which he names *T. fischeri*. I find the Academy's specimen answers to the description of the species last named. But Burmeister had previously described this form under the names of *T. fuscus*. Geoffroy subsequently named it *T. fuscomanus*. Forbes[3] decides without criticism that the names *T. fuscomanus* and *T. fischeri* are synonyms of *T. fuscus*. In the same volume *T. spectrum* is changed to *T. tarsius*. I have accepted this plan of naming the two species, and thus the Academy's specimen becomes *T. fuscus*. Mr. Lyddeker informs me by post, that while he uses the name *T. fusco-manus* in his work on Geographical History of the Mammalia, he would now accept *T. fuscus*. A. B. Meyer[4] employs *T. fusco-manus*, though changing it to *T. fuscus* in a later publication, which unfortunately is not to be found in the libraries of this country. The author last named, described in the above series a new species under the name *T. philippensis*, characterized by possessing naked tarsi and tail. Professor Meyer writes that he has since described a fourth species under the name *T. sangirensis*, an account of which has not come to hand. The genus, therefore, now contains four accredited species, *T. tarsius*, *T. fuscus*, *T. philippensis* and *T. sangirensis*.

In discussing the synonymy of *T. spectrum*, Burmeister states that *T. daubentonii* is "blackish and ash-gray" in color; *T. bancanus*[5] recalls in its dark colored fur the foregoing. *T. spectrum* is "yellow

[3] Allen's N. H. Libr., Primates, 1894, I, p. 21.

[4] Abhand. u Berichte des Köngl. Zool. u Anthropolog.-Ethn. Museums zu Dresden, 1894, I.

[5] I have carefully studied the account of *Tarsus bancanus* Horsfield (Nat. Hist. Java). It has minute lateral incisors and no upper central incisors. The premolars and molars together number but five; it is probable that the first premolar is absent. The tarsus is less elongated, the ears are smaller and the tail less pencillated than in *T. fuscus*. The form is most likely immature.

brown-gray" with a light dash of "red-brown" on the forehead, the back and upper side of the thigh; the sides of the head and neck are dark brown, the breast whiter. The tip of the tail is yellow and bristle-like. *T. fischeri* (the *T. fuscus* of this paper) is of a reddish yellow-gray, with brown-gray side of head and neck, a clear yellow-white spot on the base of the ear, and a red-brown tip to the tail. Two conclusions can be drawn from these excerpts: one that Burmeister's account of the specific distinctions is not satisfactory, and that the Academy's specimen is remote from *T. tarsius*. It is in the broadest possible way contrasted with the coloration of the figure in Burmeister's memoir. Here the fur of the body and the limbs is of a uniform yellow-gray, the head being somewhat darker, the tip is scarcely more densely furred than the rest of the tail and not differently colored.

THE AURICLE.

The auricle is more rounded than in *T. tarsius*. A distinct internal basal lobe is present, which, however, is folded in against the auricle. The outer border ends abruptly at the middle of the large, rounded external basal lobe, which is absent in the species just named. The antitragus is convex and projects but to a less degree than [redacted]

THE HANDS AND FEET.

The nails of both hands and feet, with the exception of those of the second and third toes, are almost entirely concealed by epidermis. They are, indeed, mere scales, which apparently represent the lowest possible phase of development. Those of the feet are as in the hands, excepting those of the second and third toes. The well-known prorect claws have been aptly compared to thorns on a rose bush. They stand at an acute angle to the sharply flexed second phalanges and permit the broad toe-tips to project to a greater extent than in other toes. I venture in this connection to make a suggestion as to the use of these claws. They are fur dressers and parasite searchers for the head and shoulders. It is a matter of common observation that ecto-parasites are prone to fix themselves about the face and ears. A palmate-finger-tipped animal would be placed at a disadvantage at the toilet. It is probable that when the claws are in use the fourth and fifth fingers are flexed.

The palmar callosities are marginal to the thenar and hypothenar eminences. The basal pads in the digits are large—one is proper to the fourth digit. Burmeister simply states concerning the two basidigital pads that they lie at the base of the middle and following finger.

In the foot the hallucal and hypothenar pads are strictly marginal. They join at the wrist. A metatarso-phalangeal pad lies axial to the third digit. A large pad lies axial to the phalanges of the hallux. It projects into the first inter-digital space and is well displayed when this space is defined from the dorsum. All three pads are in effect callosities to the metatarsal and the metatarso-phalangeal joints except the first, which overlies in part the powerful *Adductor pollicis*.

The pad of the first toe is opposed to that of the fifth toe. The manner of insertion of the *Adductor pollicis* would naturally have a tendency to pull the entire digit to the ulnar border while flexing the phalanges. The location of the tendon is seen without dissection. The hallucal pad overlying this muscle in part is an interesting structure. This portion of the manus and pes in mammals generally, so far as I know, is free from callosities. But in *T. fuscus* the pad is the largest in the foot and projects toward the sole so as to suggest an important function in grasping.

Burmeister does not acknowledge the marginal pads to be present, but describes three unequal elliptical pads which answer in part to the free basal segment ; the middle corresponds to " den beiden ersten Zehen " (second and third digits), the third, the smallest but longest on the outer (fibular) border of the " zwei letzten Zehen " (fourth and fifth digits). Thus no statement is made of the extent to which the pollical pad overlies the first inter-digital space, as is seen in the Academy's specimen, and of the third pad lying to the outer side of the last two toes. In the Academy's specimen it is distinctly inter-digital.

THE SKULL.

The skull of *T. fuscus* differs from that of *T. tarsius* in the tympanic and petrous portions of the temporal bone being greatly inflated, in the orbital border of the malar bone being notched instead of perforated, and the orbital plate of the frontal bone being smooth instead of furnished with a tuberosity over the inner border of the optic foramen. A skull of *T. tarsius* in the possession of the Academy of Natural Sciences of Philadelphia is older than that of *T. fuscus*, yet the position of the para-conules and the meta-conules is cleanly defined.

The infra-orbital canal is minute; the post-glenoid foramen is conspicuous. The union of the external pterygoid plate with the petrous portion of the temporal bone is met with in some short faced types in Chiroptera. The interesting comment is made that in those

[redacted]

crown. The molars increase in size from the first to the third, the last named alone having a marked posterior commissural cusp, though a faint rudiment of it can be discerned in the first and second.

Fig. 3. The Lower Teeth of *Tarsius fuscus*.

The anterior eminence is seen in all, though it is least conspicuous in the first tooth. The large metaconid is separated from the small hypoconid by a deep valley. The sharp posterior commissure is continuous with the apex of the hypoconid. In the first and second molars the commissure is straight and transverse, but in the third tooth it is prolonged backward; beyond it, the swollen contour of the tooth projects and yields the impression of being a supplemental cusp; so that the series when viewed from buccal aspect gives to the first and second molars two denticles, while for the third molar there are three. A cingule is sharply defined at the basis of the paraconid and metaconid. All the lower teeth have cingula. In the incisors, canines and premolars they are entire or nearly so; in the molars they are buccal only.

The Upper Teeth.—The conical central incisors are separated from one another at their apical thirds. They are sharply worn on the posterior surfaces and faintly grooved on the outer. The lateral is contiguous to the central, but separated from the canine by a narrow interval. The tooth is minute, higher than the central, its tip being on the level of the cingulum of the tooth last named. The canine is smaller than the central incisor. The premolars abruptly increase in size from before backward; the first two are ridged on palatal surface like the canine; the third alone presents on palatal surface a broad basal cusp.

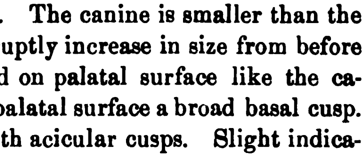

Fig. 4. The Upper Teeth of *Tarsius fuscus*.

The molars are trituberculate with acicular cusps. Slight indications exist of the beginnings of cusps (conules) on the commissures uniting the protocone with the paracone and metacone. The cingulum is not complete in any of the molars, though nearly so in the first and third. In the second no trace of it exists on the palatal aspect of the second molar, the figure represents the line with too much emphasis.

The protoconids and paraconids are received in interdental spaces of the upper jaw. The hypoconids occupy the valleys of the upper molars. The valleys of the lower molars embrace the protocones. The interdental spaces of the lower jaw are occupied by the metacones. The minute cusps on the ridges connecting the paracone and mesocone with the protocone are met with also in *Lemur*. The disposition is an ancient one, since it is seen in *Chriacus* of the Puerco beds. In *Anaptomorphus* and *Pelycodus* it is less marked, if indeed indubitably present. Theo. N. Gill[6] and Max Schlosser[7] place *Tarsius* in a group distinct from the Lemuroidea, but closely related thereto. C. E. Hubrecht[8] removes the form absolutely from proximity to the lemurs, and gives it a place in the phyllum of the monkeys and men. C. Earle[9] considers *Tarsius* to be an annectant type between the apes and lemurs.

The wear is first on the ridges between the protoconids and paraconids and the anterior of the two ridges of the molars, and between the hypoconid and the posterior of the two ridges.[10]

THE RUGÆ.

The palatal rugæ are nine in number. The first five lie between the premolar and canine teeth; they answer to the abruptly narrowed part of the hard palate, and while composed of right and left parts are irregular and crowded. The remaining four are regular and undivided. Directly back of the incisors is a median part with two minute depressions.

[redacted]

THE MUSCLES OF THE LOWER JAW.

Unlike other forms of *temporal* muscle, the superficial and posterior fascicle overlies to a slight extent only the anterior and deeper part, but in the main arises separately from the skull. It can be raised easily by the director just above the auditory meatus and separated from the anterior fascicle by a little artificial dissection.

The *masseter* muscle arises from the inferior orbital margin. The anterior surface as it overlies the lower jaw reaches a line answering to that of the third molar, almost as far as the anterior edge of the line of origin of the muscle. But its insertion is strictly confined to the angle of the jaw; thus a probe can be passed between the anterior third of the muscle and the lower jaw.

The *digastric* muscle is without tendinous intersection, and is inserted almost the entire length of the lower jaw.

THE MUSCLE OF THE SUPERIOR EXTREMITY.

The muscles which are attached to the occiput and cervical vertebræ on the one part and the shoulder girdle and the side of the chest, humerus and bones of the forearm on the other, constitute a natural system, though they are variously distributed in the generally accepted myologic scheme.

I place in this system the following muscles, the grouping by brackets indicating the association through annectant fascicles:

$\left\{\begin{array}{l}\text{Sterno-cleido-mastoideus.}\\ \text{Trapezius.}\end{array}\right.$

$\left\{\begin{array}{l}\text{Splenius.}\\ \text{Scalenus anticus.}\end{array}\right.$

$\left\{\begin{array}{l}\text{Transversalis colli.}\\ \text{Pectoralis major.}\\ \text{Serratus magnus.}\end{array}\right.$

$\left\{\begin{array}{l}\text{Deltoideus.}\\ \text{Pectoralis major.}\\ \text{Brachialis anticus.}\end{array}\right.$

Rhomboideus.

Levator anguli scapulæ.

Latissimus dorsi.

The *Sterno-Cleido-Mastoideus* is a sheet whose fold[11] lies at the median border. The clavicular and sternal origins are continuous,

[11] For an opinion entertained respecting muscles which are composed on the plan of a folded sheet, see a paper by the author on the Muscles of the Limbs of the Raccoon (*Procyon lotor*), Proceedings of the Academy of Natural Sciences of Philadelphia, May, 1882.

and are concealed by the upper margin of the *Pectoralis major*. The clavicular sheet makes up the bulk of the muscle and constitutes the superficial fascicle. The sternal sheet is thicker than the foregoing and constitutes the deep fascicle. The *Splenius* lies in part between the two fascicles. The extent of the insertion of the muscles, namely, along the entire length of the occipital ridge (*linea semicircularis ossis occipitis* of Burmeister) is noteworthy. The *Trapezius* sends a slip to the posterior border of the foregoing sheet at a point answering nearly to the level of the axis. Burmeister gives two distinct origins with a triangular interval between them. No mention is made of the clavicular and sternal fascicles being united at the median border of the muscle.

The *Trapezius* is without a capitate slip. The upper fascicle, confined to the cervical region, is small and inconspicuous. The middle fascicle is continuous with the foregoing and ends abruptly about on the line of the inferior end of the vertebral border.

The *Splenius* is a broad simple sheet. It sends a small fleshy slip to a superior angle of the scapula and a broad tendinous slip to the *Scalenus anticus*.

The *Transversalis colli* can be traced to the junction of the superficial and deeper parts. The deep fascicle merges with the above near the insertion ; both fascicles are beautifully delineated in Burmeister's plate. The terms in which the *Pectoralis major* are defined present a scheme as simple as any found elsewhere in the mammals.

[redacted]

ialis anticus. Accepting this union as valid, the cephalo-humeral system ends by the insertion of the *Brachialis anticus* upon the ulna.

The *Brachialis anticus* is a large, powerful muscle; it arises by two heads, one in continuity with the *Deltoideus* at the pectoral ridge, and the other (the larger) from the outer surface of the shaft just below the origin of the outer head of the *Triceps.* It has a broad tendinous insertion on the ulna. It is more important apparently than the *Biceps*, and unlike the same muscle elsewhere in the mammalia it is not associated with the *Triceps.*

The *Rhomboideus* is small without capitate slip. An important difference is here noted in Burmeister's description. The *Rhomboideus* is figured with an accession about the position of *Rhomboideus major*, and a large muscle resting on the *Splenius* named *Levator posticus scapulæ* which is the same as the capitate fascicle of later writers. The Academy's specimen shows no muscle intervening between the *Sterno-cleido-mastoideus* and the *Splenius.*

The *Levator anguli scapulæ* arises from the transverse processes of the fifth to the seventh cervical vertebræ, and is inserted on the superior angle of the scapula.

A muscle arises from the front of the atlas in association with the *Longus colli,* and is inserted upon the acromion in connection with the *Trapezius.* This is the *Levator anticus scapulæ* of Burmeister's figures, but is not described.

The *Latissimus dorsi* is without axillary arches and arises entirely from the dorsal aponeurosis, where the muscle is 23 mm. wide. This is also the case in Burmeister's specimen. The slip to the olecranon is in close union with the connective tissue over the median nerve and brachial artery, and the impression is received that the slip protects these structures from the effects of friction and pressure.

The other muscles not embraced in the preceding group are the following:

The *Omo-hyoideus* is broad, conspicuous and without intersection.

The *Biceps flexor* is relatively a weak muscle. The association with the *Coraco-brachialis* conforms to the primate type.

The *Triceps* muscle is fully described by Burmeister who, however, includes it in the slip to the olecranon from the *Latissimus dorsi.* The third head (*Anconeus tertius*) arises from the supra-condyloid ridge in part. The three heads do not form a single tendon of insertion. The first two heads are almost separate and measurably distinct from the third. The *Anconeus* constitutes a

thick mass of minute fibres occupying the interval between the humerus at the epicondyle and the olecranon.

The *Supinator longus* is inserted on the dorsal aspect of the *trapezium* and not on the distal part of the radius, though it is held down firmly to that bone. This result has been obtained after a careful dissection. According to Burmeister the tendon runs along the edge of the radius and turns toward the carpus—before reaching this region, however, it is attached to the outer and lower end of the radius, being somewhat broader as it does so. It passes under the *ligamentum carpi dorsalis.*

In his account of the *Supinator brevis* Burmeister does not mention the ossicle in the tendon of origin, which was present in the Academy's specimen.

The *Palmaris longus* is in closer relation to the *Flexor carpi ulnaris* than is the muscle first named to the *Flexor sublimis digitorum.*

The *Flexor sublimis digitorum* and *Flexor profundus digitorum* are distinct with the exception of a delicate tendon which unites the muscles as they cross the wrist.

The *Flexor profundus digitorum* consists of two divisions; one for the first and second digits is the main mass and arises from the radius, the other passes to the remaining digits. Each division is made up of two heads. The above account is distinct from the one elaborately stated by Burmeister, who gives three heads for the

The radial carpal extensors are inserted upon the radial side of the base of their respective metacarpal bones. These facts are significant since they point to flexion of hand or forearm, while the latter is semiprone, which is the position proved by the study of joints to be characteristic.

The *Extensor carpi radialis longior* goes with the *Supinator longus* since the two are united, and the *Extensor carpi radialis brevoir* goes with the *Extensor communis digitorum*, but the *Extensor carpi ulnaris* does not go with the *Extensor minimi digiti* in the sense that the two are united.

The *Extensor communis digitorum.*—This muscle is the more superficial of the two extensors. It does not supply the first finger. It is composed of two slips which separate at the proximal third of the forearm and are far apart at the wrist; the inner (radial) passes to the second, third, fourth and fifth fingers, and the outer (ulnar) to the fourth and fifth. Thus the fourth and fifth fingers are doubly supplied. Burmeister separates the last named divisions under the name of the *Extensor digiti quarti et quinti*, but the remaining part is not the *Extensor digiti indicis et medii* unless we accept this fascicle as having a wider range of insertion than is normal to *T. tarsius.*

Assuming that all the extensors (excepting those of the first finger) described by Burmeister are embraced in the above account, a large muscle in the Academy's specimen remains undescribed. This muscle which is analogous to the *Flexor profundus digitorum* is much smaller than the *Extensor communis.* It arises from both bones of the forearm but not from the humerus, and is inserted into all five fingers. The tendon to the first finger is given off high up, but unites with an aponeurotic layer which holds together the tendons to the second, third and fourth fingers. The tendon to the fifth finger is next longest to the first and is without aponeurosis.

The *Extensor communis digitorum* sends a slip high up from the belly; it passes through a separate sheath at the wrist (at the head of ulna) and goes to the fourth and the fifth digits. This probably is the *Extensor minimi digiti.* The main muscle is distributed to all the digits.

The *Extensor minimi digiti* arises entirely from the ulna and supplies all the digits. Hence the fifth digit receives three extensor tendons.

The *Extensor pollicis longus.*—This muscle is normal to *T. tarsius.* It is the same as the *Abductor pollicis longus* of Burmeister.

The *Extensor pollicis longus* of Burmeister is not present in *T. fuscus.* It may be found in the pollical slip of the deep extensor as named in the foregoing paragraph.

The *Flexor pollicis brevis* and the *Abductor pollicis brevis* form one muscle. Burmeister separates them.

The *Abductor pollicis* arises from the fibrous tissue deep in the palm over the *Palmar interossei.* It has no bony origin whatever. Burmeister assigns an origin from the third metacarpal bone. His figure gives the impression of an origin from the fourth metacarpal.

The *Opponens pollicis* is absent. Burmeister describes and figures this muscle. The *Abductor indicis* is a small muscle; it is described by Burmeister.

The *Abductor minimi digiti* embracing the *Flexor brevis minimi digiti* are as in Burmeister's description. The muscles are imperfectly differentiated.

The *Palmar interossei.*—The muscles occupy the opposed sides of the second and third digits, and of the third and fourth digits as given by Burmeister. The pair of muscles for the third and fourth fingers form a fleshy union at the distal end of the first phalanx and the proximal end of the second. Traction flexes the finger powerfully. The muscle to the fifth finger does not flex the finger but extends and abducts it. For the fourth and fifth fingers the arrangement is as follows: A muscle arises from unciform bone and lies on [redacted]

from a palmar group. Burmeister gives the numeration as above, but the muscles are too closely united to agree with *T. fuscus*, while the difference in the ulnar muscle of the fourth finger is not given.

In reviewing the muscles of the hand, both intrinsic and extrinsic, one is struck with the fact that the ulnar division of the hand is more highly endowed than the radial. The extensors of the fingers are connected with the first interphalangeal joints by broader and more powerful bands on the ulnar than on the radial sides. The *Palmar interossei* are much larger and more powerful on the ulnar than on the radial sides of the third and fourth fingers. The *Dorsal interosseous* muscle for the ulnar side of the fourth finger is much broader and thicker than its fellows.

THE MUSCLES OF THE INFERIOR EXTREMITY.

The *Biceps femoris* arises in common with the *Semitendinosus* from the ischial tuberosity. It is with scarcely any disposition to extend down on leg, either in tendon or aponeurosis. The entire process stops at the proximal fourth of the leg. One sheet of aponeurosis passes to the crest of the tibia, and to the intermuscular septum between the *Gastrocnemius* and the *Peroneus longus*. The relations of the muscles are quite as in other mammals. The *Semimembranosus* is without transverse inscription. The *Semitendinosus* possesses one, or at least the belly is digastric. The muscle last named with the *Gracilis* and *Sartorius* form one tripartite muscle.

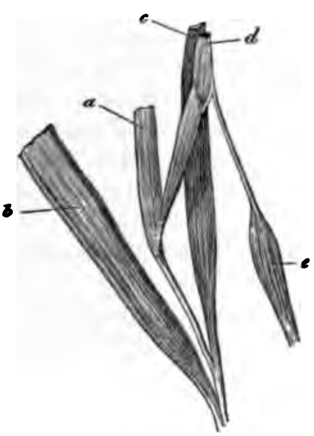

Fig. 5. The hamstring muscles of *T. fuscus*: *a*, gracilis; *b*, sartorius; *c*, semimembranosus; *d*, semitendinosus; *e*, biceps.

The extremely weak *Biceps*, which secures no independent origin, forces one to the conclusion that it is related to the ham strings only, and not to the *Gluteus maximus* whose relations to the femoral shaft are secured through another associate, namely, the sheet I call the "Annectant Mass." Burmeister's account of the *Biceps* is quite different from the foregoing. The muscle arises from the ischial tuberosity and receives a few fibres only from the *Semitendinosus*. The difference is more

apparent than real. It might with exactitude be said that both *Biceps* and *Semitendinosus* have a common ischial stem. Certainly it cannot be said, as Burmeister asserts, that the *Biceps* is the most powerful of the ham strings.

The "Annectant Mass" between the *Gluteus maximus* and the *Semimembranosus* arises from the transverse processes of the caudal vertebræ just below the sacrum by a line 7 mm. in breadth, as well as from the tuberosity of the ischium above the origin of the ham strings. It is inserted by fleshy fibres on the shaft of the femur for a little over one-half of its length. At the caudal origin it is in contact with the *Gluteus maximus* at its ischial origin with the ham strings and at its insertion with the *Adductor magnus*, if, indeed, it may not be said to merge with this muscle. It cannot be freed from fascia without artificial dissection, being continuous with the fasciculation anteriorly and with the firm connective tissue layer over the *Semimembranosus* posteriorly.

Burmeister names this muscle the *Pyriformis*. The mutilation of the Academy's specimen in the region of the pelvis prevented a satisfactory study being made of the muscles arising from the sacrum and inserted on the bones of the inferior extremity. This fact does not prevent the observer from deciding for himself the identity of the muscle here described. The well known disposition of the *Semimembranosus* to secure an origin from the vertebral column [redacted]

cessions. The mass arising from the lower half of the front of the femur is normal.

The leg can be extended on the thigh scarcely to a right angle. Yet the great bulk of the *Quadriceps* is required to do this much.

The patella is small (4 mm. + 2½ mm.) while the patellar groove on the femur is deep and long. This notch is much deeper on the outer than the inner side. The patella scarcely occupies the groove but lies well toward the intercondyloid notch.

The *Plantaris* passes almost entirely to the first toe, a fibrous band passing to the base of the first phalanx of the second toe and another joining the *Transversalis pedis superficialis*.

The *Extensor longus digitorum pedis* passes to the outer side of the tibia as the *Tibialis anticus* and *Extensor longus pollicis* pass to the inner side. It lies beneath the annular ligament and directly in front of the ankle joint, though above the calcaneum it passes under a special ligament which holds it close to the bone last named. At the mid-tarsal region it again passes beneath a special ligament and forms two aponeurotic expansions, the inner supplying the second, third and fourth, and the outer the third, fourth and fifth digits. Tracing these tendons back to their origin it is found that the outer division retains the largest fleshy fascicle.

The *Peroneus longus* (*Peroneus primus* of Burmeister).—This muscle exerts no action on the entire foot except in its effect on the first metatarsal bone. Traction pulls the bone forcibly inward by a bold free motion. It has no effect on the cuboid bone.

The *Flexor communis digitorum* is a large, powerful muscle. It arises from the tibia by fleshy fibres half way down the posterior surface of the shaft. It unites with the *Flexor longus pollicis pedis* to form one tendon at the mid-tarsal region. At this point a strong tenaculum (which serves as a check to extreme contraction) attaches itself to the under surface of the common tendon and holds it to the calcaneum. I venture to call the *Lumbricales* the para-fascicles. The first toe has none; the second one; the third three; the fourth two; and the fifth toes one para-fascicle.

The *Tibialis posticus* is very small; it arises high up in the leg and is chiefly derived from the fibula and the interosseous membrane. The slender thread-like tendon is inserted upon the scaphoid bone.

The *Abductor externus minimi digiti* is the same as described by Burmeister.

The *Abductor internus minimi digiti* of Burmeister could not be traced further than the proximal end of the metatarsal bone, while Burmeister states that it extends along the border of the metatarsus together with the sheath of the *Flexor longus* to be inserted upon the first phalanx.

The *Abductor hallucis* arises from the distal end of the scaphoid bone and is inserted on the fibular side of the first phalanx. The *Flexor brevis hallucis profundus* takes origin from the cuneiform bones as described by Burmeister, but the two heads named by him do not exist nor is there connection with the first metatarsal as he describes. It is inserted on the fibular side of the first phalanx.

The *Abductor minimi digiti* and the *Interossei interni* are as described by Burmeister.

The *Flexor brevis pollicis brevis* is a thick, stout mass arising from the cuneiform bones and inserted upon the fibular side of the base of the first phalanx. Parallel to the foregoing, near the *Transversalis pedis* and inserted just in advance of it, lies a muscle which corresponds in the respects named to the *Transversalis pedis profundus* of Burmeister. But it arises from the ecto-cuneiform bone and has no connection in origin with the shafts of the metatarsi. Even the *Transversalis pedis* is without origin from the second or third metatarsi, but arises from the base of the second metatarsus and thus recalls the *Abductor pollicis*.

[redacted]

and are inserted as one continuous sheet upon the bases of the second and third metatarsi. Nothing comparable to these fascicles are described by Burmeister.

The *Abductor pollicis pedis* is quite as described by Burmeister.

Burmeister gives an account of a muscle named by him *Abductor hallucis* which arises from the plantar fascia and is inserted upon the fibular side of the first phalanx on a level with the foregoing. No such muscle is found in *T. fuscus*, but a number of tendinous fibres pass in its place from the plantar fascia to the *Transversalis pedis*. The *Flexor brevis digitorum* sends a large fascicle to the toe, and it is possible it is this slip which Burmeister has named separately.

The *Abductor digiti minimi extensor* and the *Abductor digiti minimi internus* are distinct muscles corresponding exactly to Burmeister's description.

The *Abductor digiti minimi* arises by two distinct heads instead of one as described by Burmeister. Both muscles touch the belly of the *Palmar interossei* instead of permitting an interval to be defined between them.

The *Extensor brevis digitorum pedis* in addition to its origin from the calcaneum yields a slender tendon from the belly of the *Extensor longus pollicis* high up on the leg. Burmeister does not mention this slip nor is it figured by him. The first, second and third digits possess separate extensors which are specializations from the *Extensor brevis digitorum* of human anatomy.

The *Plantar interossei.*—Seven muscles are seen on the plantar aspect. The first muscle is inserted on the tibial side of the second metatarsal bone; the second and third muscles on opposed sides of the second and third bones; the fourth and fifth muscles on opposed sides of the third and fourth bones; the sixth muscle on the fibular side of the fifth metatarsal bone.

The *Dorsal interossei.*—Three muscles are seen on the dorsal aspect. One on the tibial side of the second metatarsal bone answers to the first *Plantar interosseous.* One on the tibial side of the third metatarsal bone answers to the third *Plantar interosseous;* one on the tibial side of the fourth metatarsal bone answers to the sixth *Plantar interosseous.*

The dorsal muscles are those which at the same time are the most powerful of the plantars. In other words the plantars which are the more powerful occupy in their surfaces of origin the sides of the metatarsal so completely as to be visible from the dorsal aspect of

the foot. They uniformly arise more superficially on the plantar surface and in part overlap the others. The more powerful muscles tend to abduct the metatarsi; the weaker to antagonize these and to adduct the metatarsi.

Burmeister reverses the proportions of the two sets of muscles. The figure (fig. 11, taf. 5) expressly shows the adducting set and named by him the plantar to be the larger and more superficial.

NOTES ON THE MECHANISM OF THE LIMBS.

The superior extremity is small and weak.[12] Flexion of the elbow is but 10 mm. as measured by the excursus of the head of the ulna. The bones of the forearm do not agree with Burmeister's description, while his figure of the relation of the radius and ulna are again quite different from that in *T. fuscus*. Instead of a wide interosseous space the specimen shows a narrow one, the bones are almost in contact except at the middle third where the interval is but one-half mm.

The radius moves scarcely at all on the ulna, so that pronation and supination are not as marked as would be inferred from the size of the *Pronator radii teres* and the two supinators.

The presence of a bold ridge on the outer side of the humerus above the epicondyle answers to the large *Supinator longus* in alliance with the *Extensor carpi radialis longior*.

The hand lies at right angles to the forearm by extreme dorsal

[redacted]

the muscle last named on the lower edge of the bone. Observation of the specimen when flayed shows a decided antero-posterior curvature of the cervical vertebræ.

The singularly small innominate bone indicates that no correlation can be established between it and the rest of the enormous inferior extremity. The following are the measurements of the bone: Tuberosity to pubis 15 mm.; center of acetabulum to vertebrate margin 2½ mm.; width and length of sacral facet 3 mm.; length of ilium 22 mm. The ischial spine is very prominent and shows exceptional power in the *Obturator internus* and *Gemellus superior*. While the bone is but 28 mm. long the rest of the limb measures 183 mm.[15] The knee joint is remarkable for the great contrast between femoral condyles, the outer being twice as large as the inner. The patellar notch, as already noted on p. 49, is extraordinarily long and deep, being 7 mm. long, while the condyle is but 3 mm. The groove appears to represent on the front of the joint the obliquity of the outer tibial tuberosity on the back.

The fibula joins the shaft of the tibia at the beginning of the distal third. The position of the head is indicated. Burmeister's description corresponds to the above, though from the figures it could be inferred that the shaft of the bone was outlined throughout, i. e., never having been lost in that of the tibia. The excursus of the heel (taken as a measurement of the range of knee joint) is 29 mm.; that of the mid-tarsal joint (taken as a measurement of the ankle movément) is 7 mm.

The astragalus is one-third the length of the scaphoid bone. The scaphoid at the astragalus rests in front and over the calcaneum, but at the mid-tarsal joint the scaphoid is on the same plane with that of the calcaneum. The motion between the scaphoid bone and the astragalus recalls that between the radius and the humerus, the position at rest is semipronation, and the excursus is to yet deeper pronation; there is no supination.

The general aspect of the plantar surface is like that of the forearm in most mammals if the scaphoid and the calcaneum might be compared to the radius and the ulna, while the cuboid and ento-cuneiform bones might be compared with the pisiform bone and trapezium. In *Tarsius* both the cuboid and the ento-cuneiform

[15] The thigh, tibia and foot are each about 60 mm. long when dissected, but in the undissected limb, owing to the flexing of the finger, the foot is 52 mm. long.

bones form conspicuous projections into the sole, and thereby define the sides of a depression in which lie the conjoined tendons of the *Flexor longus digitorum* and the *Flexor longus pollicis pedis.*

The *ligamentum plantare longum* of Burmeister is the same as the suspensory ligament. It extends *pari passu* with the elongation of the scaphoid bone and bears a close resemblance to a tendon of a muscle. It attaches itself to the tibia and the distal end of the scaphoid bone, some fibres being held to the calcaneum opposite the astragalus, others being merged with those forming the posterior ligament of the ankle joint. The metatarso-phalangeal articulations are extremely loose and the toes are so disposed as to show tibial deflection, the longer ones overlapping the shorter. The thumb on the other hand shows fibular deflection being drawn toward the palm by powerful muscles. The first row of phalanges is not extended on that of the metatarsus (as the first row of phalanges is extended on that of the metacarpus) but is on the same line. The second to the fifth toes resemble the fingers in motion and position, but the great toe remains extended.

The weakness of the foot support is doubtless harmonized with the extent of the knee flexion. Hence the muscles of the calf practically disappear in the deep recess between the ham strings. The inclination forward of the trunk is checked by the great mass of the *Erector spinæ* muscles, with which the deep groove between the dorsal and broad transverse processes of the thoracic and lumbar vertebræ cor-

A reasonably good conception of the mechanism of the foot is secured by placing it longitudinally on the upper surface of a small rounded stem. The pollex holds to the side of the stem, the short second and third digits to the top, and the longer fourth and fifth digits to the outer side. These dispositions show how well adapted the foot is for both support and prehension. The method of progression accepted by the animal is not so well shown. But doubtless the "spring" of the limb enables the foot to quickly let go its hold. The arrangement might be called one for longitudinal perching as contrasted to the transverse perching of birds and the chameleon. If the view here expressed be accepted, the positions in which the foot is drawn by Burmeister and Brehm are erroneous. In Burmeister's memoir the grasp is that of the human hand, the thumb being on one side of a small bough and all the other digits on the other. In the main figure of Brehm[14] the foot is transverse to the bough. In the smaller figure it is longitudinal. But the bough is so large in the illustration that it makes but little difference what the position of the foot may be. Cuvier[15] represents the foot in the position here claimed on anatomical grounds to be correct for small boughs. The inference to be drawn is the following: *Tarsius* is specially adapted to spring lightly along small boughs and limbs of trees by the longitudinal perch. It may modify the grasp on large, broad surfaces.

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[14] Thierleben, I, 274.
[15] Règne Animal.

A COLLECTION OF FISHES OBTAINED IN SWATOW, CHINA, BY MISS ADELE M. FIELDE.

BY CLOUDSLEY RUTTER.

In the year 1885, Miss Adele M. Fielde, a well-known missionary, then resident in Swatow, China, sent to the University of Indiana, a considerable collection of the fishes of that port. A series of these fishes, still undescribed, was purchased by the Leland Stanford, Jr. University, and placed in my hands for study and identification. These species, 73 in number, are enumerated in the present paper. At the end of the paper, I give a nominal list of the species recorded from Swatow, not contained in this collection. Dr. H. E. Sauvage[1] gives a list of 68 species, only 23 of which were sent by Miss Fielde. Dr. Franz Steindachner describes[2] three new species of gobies not in the present collection. These species are included in the present list on the authority of Sauvage and Steindachner.

My obligations are due to President Jordan for various aids in this investigation which was placed by him in my hands.

GALEIDÆ.

Prionace glauca (Linnæus).

Squalus glaucus Linnæus, Syst. Nat., Ed. X, 235, 1758.
Carcharias glaucus, Günther, Cat. Fishes, VIII, 364, 1870.

[redacted]

Dasyatis walga (Müller & Henle).

Trygon walga, Günther, Cat., VIII, 475.

Recorded by Sauvage.

SILURIDÆ.

[1]**Chlarias fuscus** (Lacépède).

Macropteronotus fuscus Lacépède, Hist. Nat. Poiss.
Clarias fuscus, Günther, Cat. Fishes, V, 18, 1864.

Two specimens, 6½ inches long.

Top of head 3½ ; depth 6 in length ; eye 5 in interorbital. D. 56 ; A. 43 ; P. 1–8.

Gill membranes united at a broad angle, only the margin free from the isthmus. Dorsal and anal single, long, separated from caudal. Chamber for the dendritic accessory branchial organs closed by palmate flaps, situated on the gill arches. A prominent notch with a fleshy protuberance above it on anterior edge of shoulder girdle. The clavicles form broad striate plates, covered by thin skin, meeting by suture, the hinder edges forming a broad angle. Head depressed, its width 1⅗ in length, equal to head in front of snout; occipital process broadly rounded; upper and lateral parts of head osseous, granular, covered by thin skin. Two fontanelles, one just back of eye, the other in front of occipital. Eyes small, with free margins. Head depressed, its width 1⅗ in its length, equal to head in front of occipital fontanelle. Villiform teeth in bands on jaws and vomer. Barbels eight, that of the maxillary reaching tip of pectoral spine, the nasal scarcely to base of occipital process. Pectoral only with spine, which is 2⅗ in top of head, anterior edge thin and finely serrate, irregularly serrate behind. Origin of dorsal over tips of pectorals, ventrals reach origin of anal, caudal slightly rounded. Color, in alcohol, uniformly dark above, lighter on belly.

Tachysurus sinensis Lacépède.

Tachysurus sinensis Lacépède, V, p. 151, pl. 5, fig. 2, China.
Arius falcarius, Günther, Cat. Fishes, V, 168, 1864; Day, Fishes of India, 468, pl. 106, fig. 5, 1888.

Three specimens, 3½ inches long.

Head 4; depth 5½ ; eye 4⅗. D. I, 7 ; A. 16 to 18.

CYPRINIDÆ.

Cyprinus carpio Linnæus. Günther, Cat. IV, 25.

Recorded by Sauvage.

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[1] This generic name dates in binominal nomenclature from Scopoli, 1777, who spelled it *Chlarias*.

Carassius auratus Linnæus. Günther, Cat. IV, 32.

Recorded by Sauvage.

Labeo decorus Peters.

Labeo decorus Peters, Monatsbericht der Königl. Akademie der Wiss. Berl., Dec., 1880, p. 1031.

Two specimens, $4\frac{1}{2}$ and 6 inches long.

Head $4\frac{1}{3}$; depth $3\frac{1}{5}$; eye 3; scales 8 or 9–38–5. D. 15; A. 7; P. 17; teeth 5, 4, 2–2, 4, 5.

Dorsal and ventral profiles about equally arched, not concave above eyes. Snout blunt, little projecting, three folds to upper lip, an outer simple membrane, an inner one, soft, cartilaginous covered with a horny substance, between them a fringed fold. Lower lip with a horny-covered fold, which is continuous with the fringed fold of the upper lip; outside of this the lip is full and finely papillose. Diameter of eye equals width of mouth, equals snout, and is $1\frac{1}{2}$ in interorbital space. Rostral barbel longer than and reaching the base of the maxillary barbel, a pore at its base. Pharyngeal bones small; the teeth set very obliquely, almost parallel with the upper arm of the bone; their crowns scarcely oblique, close together, each with a raised edge and grooved in middle. Dorsal inserted midway between snout and end of anal, its height equal to its base, free margin emarginate. Pectorals nearly as long as head, shorter than ventrals. Ventrals inserted under seventh ray of dorsal, midway between tip of snout and base of caudal. Caudal deeply forked, [redacted]

Head 4⅗ in length to base of caudal; depth 2½; eye 2⅘ in head; scales 6–34–5. D. 17 or 18; A. 13 or 14.

Dorsal beginning over middle of space between ventrals and oval, a little nearer caudal than tip of snout. Ventrals nearly reaching anal; origin of anal under fourth branched ray of dorsal; end of dorsal over next to last ray of anal; pectorals nearly reaching ventrals, equal to length of tail from anal. Least depth of tail 1½ in its length, equal to distance between pectoral and lateral line. Teeth with a few serræ. Barbels rather well-developed, ⅓ length of eye. Snout ⅘ of eye. Length of head equal to greatest distance above lateral line, depth of head equal to or a little less than greatest distance below lateral line. Caudal forked. Color, in alcohol, olivaceous, a narrow, dark band on side of tail, pointed anteriorly and two obscure blotches on each side behind head, above lateral line; dorsal with two rows of dark spots on the rays.

This species is closely related to *Acanthorhodeus guichenoti* Bleeker, differing in having a more slender body with fewer longitudinal rows of scales and a more posterior dorsal with but two long rays.

Squaliobarbus curriculus (Richardson).

Leuciscus curriculus Richardson, Ichth., China, 299.
Squaliobarbus curriculus, Günther, Cat. Fishes, VII, 297, 1867.

Six specimens, 3½ to 6½ inches long.

Head 4; depth 4; eye 4; scales 8–42–3. D. 8 or 9; A. 9; V. 9; teeth 5, 4, 2–2, 4, 4.

Xenocypris argentea Günther.

Xenocypris argentea Günther, Cat. Fishes, VII, 205, 1867.

Five specimens, 4 to 6 inches long.

Head 4½; depth 3⅗; eye 3⅓; scales 11–60–5. D. 9; A. 12; teeth 6, 4, 2–2, 3, 6.

Teeth of outer row with grinding surface but little oblique, concave, grooved.

Chanodichthys terminalis (Richardson).

Abramis terminalis Richardson, Ichthyology China, 294 (*Günther*).
Chanodichthys terminalis, Günther, Cat. Fishes VII, 326, 1867.

Two specimens, 4 and 5½ inches long.

Head 4½; depth 2⅗ and 2⅘; eye 2⅔; scales 12–52–7. D. 9; A. 28; teeth 5, 4, 2–2, 4, 5.

Snout ⅘ of eye. Head equal to depth from origin of dorsal to lateral line, depth of head equals depth below lateral line under

origin of dorsal. Head small, an angle in outline at occiput, back slightly arched in front of dorsal. Origin of dorsal over interspaces between ventrals and anal, its longest rays nearly equal to base of anal. Pectorals almost reach ventrals. Origin of anal immediately behind dorsal. Caudal forked for nearly $\frac{2}{3}$ its length, the lower lobe longest. Lateral line distinct, decurved, interrupted on tail. Another lateral furrow or groove extends under the scales from the head to the tail, but has no pores. Sides silvery, no other color-markings.

Hypophthalmichthys nobilis (Gray).

Leuciscus nobilis (Gray) Richardson, Ich. Voy. Sulph., p. 140, pl. 63, fig. 8 (*Günther*).
Hypophthalmichthys nobilis, Günther, Cat., VII, 299, 1868.

COBITIDÆ.

Misgurnus anguillicaudatus (Cantor).

Cobitis anguillicaudata Cantor, Ann. & Mag. Nat. Hist., IX, 1892, p. 485.
Misgurnus anguillicaudatus, Günther, Cat. Fishes, VII, 345, 1867.

Head 6; depth 8; eye 5. D. 9; A. 7; V. 6.

Gill-openings not extending below upper base of pectorals; rudimentary caudal rays greatly developed, extending forward along lower edge of tail half way to tip of anal, the fatty keel extending to under tip of anal, both equally developed on dorsal side. Inner mandibulary barbels attached to base of outer.

Acanthopsis lachnostoma Rutter, new species.

[redacted]

cross series, lateral line straight. Color, in alcohol: Body reddish-brown, a series of thirteen dusky spots along lateral line, another of smaller spots along edge of back, a band of small, dusky markings between them; back with dusky blotches, six or seven in median line in front of dorsal; cheeks pale yellowish-brown, with dusky specks, a dark blue line from eye to end of snout; dorsal and caudal with small, dusky spots on rays, other fins colorless; a small, oval, black spot placed obliquely on upper base of caudal.

This species may be distinguished by its short dorsal and convex snout.

Described from a specimen 6 inches long.

MONOPTERIDÆ.

Monopterus albus (Zuiew).

Muræna alba Zuiew, Nov. Act. Ac. Sc. Petropol., VII, 1793, p. 299, tab. 7, fig. 2 (*Günther*).
Monopterus javanensis, Günther, Cat. Fishes, VIII, 14, 1870.

Two specimens, 14 inches long.

Dorsal fold of skin rudimentary on tail only. Teeth in bands in both jaws and on palatines. Eyes small, 2 in snout, above middle of maxillary. Posterior nostrils the larger, situated between the eyes; anterior nostrils in middle of length of snout. Width of gill-opening equal to cleft of mouth. Tail tapering to a point. Color, in alcohol, almost black, lighter below, with small black spots.

LEPTOCEPHALIDÆ.

Uroconger lepturus (Richardson).

Congrus lepturus, Richardson, Voy. Sulph., Fishes, 106, pl. 56, figs. 1–6.
Uroconger lepturus, Günther, Cat. Fishes, VIII, 44, 1870.

Head 9½, 2⅝ in distance from snout to vent, depth 2 in head; eye 7, 2 in snout.

MURÆNESOCIDÆ.

Muraenesox cinereus (Forskål).

Muræna cinerea Forskål, pp. X and 22, 1775.
Murænesox cinereus, Günther, Cat., VIII, 46, 1870; Day, Fishes of India, 662, pl. 168, fig. 4, 1888.

Recorded by Sauvage.

MYRIDÆ.

Muraenichthys gymnopterus (Bleeker).

Murænichthys gymnopterus Bleeker, Atl. Ich., Murènes, 32, pl. 140, fig. 1, 1864; Günther, Cat. Fishes, VIII, 52, 1870.

One specimen, 8 inches long.

Body nearly terete, slightly compressed. Dorsal fin beginning somewhat nearer vent than gill opening, anal about equally devel-

oped, both confluent with caudal, which is rayed. Pharynx somewhat saccate; gill openings much behind head, one-third the distance from snout to vent. Eye over middle of cleft of mouth, small, 1½ in snout, about equal in size to gill opening. Teeth blunt conical, one irregular row in each jaw, those at symphysis of lower jaw somewhat smaller and grouped; two rows of about six each on vomer. Maxillary extending for length of snout beyond cleft of mouth, the distance of its tip from anterior margin of eye equal to greatest depth of body. Nostrils labial. Colorless (in alcohol), finely dusted with black specks on back.

OPHICHTHYIDÆ.

Ophichthus cancrivorus (Richardson).

Ophisurus cancrivorus Richardson, Voy. Ereb. & Terr., Fish., 97, 1848.
Ophichthys cancrivorus, Günther, Cat. VIII, 78, 1870.

Recorded by Sauvage.

Pisoodonophis boro (Hamilton-Buchanan).

Ophisurus boro Hamilton-Buchanan, Fish. Gang., pp. 20, 363 (*Günther*).
Pisoodonophis boro, Kaup, Apod., p. 17 (Günther), 1856.
Ophichthys boro, Günther, Cat., VIII, 77, 1870; Day, Fishes of India, 664, pl. 171, fig. 2.

Recorded by Sauvage.

MORINGUIDÆ.

Moringua lumbricoidea Richardson.

Dorosoma thrissa (Osbeck).

Clupea thrissa Osbeck, Reise, p. 336, 1765 (*Günther*).
Clupea thrissa, Günther, Cat. Fishes, VII, 432, 1867.

Six specimens, 3½ to 5 inches long.

Head 3, depth 2¾ to 3, eye 4½ to 4; B. 6; D. 15; A. 23 or 24; P. 13 to 16; V. 8; scales about 40–19.

Jaws even in front, maxillary almost to vertical from middle of eye, no teeth; eye equal to snout, lower margin of opercle concave. Ventrals inserted under 5th or 6th ray of dorsal, under tip of pectoral, and midway between base of pectoral and origin of anal, extending half way to anal. Origin of dorsal midway between snout and caudal, dorsal filament reaching end of anal. Base of pectoral wholly below or in front of posterior edge of gill opening. 11 or 12 scutes behind ventrals. Profile more convex anteriorly, deepest just behind pectoral.

ELOPIDÆ.

Megalops cyprinoides (Broussonet).

Clupea cyprinoides Broussonet, Dec., Ich. I, tab. 9, 1782.
Megalops cyprinoides, Günther, Cat., VII, 471, 1868; Day, Fishes of India, 650, pl. 159, fig. 3, 1888.

Recorded by Sauvage.

Sardinella nymphæa (Richardson).

Clupea nymphæa Richardson, Ichth. China, 304, (*Günther*); Günther, Cat. Fishes, VII, 428, 1867.

Three specimens, 4½ inches long.

Head 4, depth 3½, eye 3 to 3½; scales, lat. l. 40, trans. 11; D. 16 or 17; A. 19 to 21; V. 9.

Lower jaw well projecting; snout shorter than eye, 3¾ in head; maxillary to vertical from anterior margin of pupil. Teeth very minute on tongue and pterygoids, in two or three cross rows on palatines, none in jaws or on vomer. Opercular bones with striæ indistinct or absent, a reentrant angle of about 50° at lower corner. Pseudobranchiæ large, the filaments free, about a dozen in number, about as large as gill-rakers. Scales with margins striate and irregularly crenulate, the middle portion more or less projecting; two or three vertical lines near base. Thirteen scutes behind ventrals. Middle of dorsal midway between snout and base of caudal, ventral below middle of dorsal. Color, in alcohol, sides below a line from upper margin of eye to upper edge of caudal, silvery, above this dark steel-blue.

Clupea reevesii (Richardson).

Alosa reevesii Richardson, Ich. China, 305 (*Günther*).
Clupea reevesii, Günther, Cat., VII, 446, 1868.

Recorded by Sauvage. I do not know to what genus this is to be referred—certainly neither to *Alosa* nor to *Clupea*.

Pristigaster sinensis Sauvage.

Described by Sauvage from Swatow.

? Engraulis chinensis

ENGRAULIDIDÆ.

Stolephorus japonicus (Houttuyn). Challenger Rept.

not *Atherina japonica* Houttuyn, Verh. Holl. Maatsch. Wet. Haarl., XX, 2, 1789, p. 340 (*Günther*).
Engraulis japonica, Günther, Cat. Fishes, VII, 390, 1867.

Six specimens, about 4 inches long.

Head 4½, depth 5, eye 3; scales about 38; D. 13 to 15; A. 19 to 22.

Abdomen not compressed, but with six weak, spine-bearing scutes in front of ventrals; origin of dorsal nearer caudal than snout, origin of anal below middle of dorsal; teeth in both jaws minute but equal in size; snout rather blunt, not much projecting, maxillary nearly to gill opening, scales entirely deciduous. A narrow silvery lateral band.

Stolephorus kammalensis (Bleeker).

Engraulis kammalensis Bleeker, Verh. Bat. Gen., XXII, 13.

[redacted]

at an angle of about 100° ; a carinated scute terminating in a small sharp spine in front of dorsal ; vertebræ 45 (*T. mystacoides*).

Trichosoma porava (Bleeker).

Thryssa porava Bleeker, Verh. Bat., XXII, Ich. Madura, p. 14, Dec., 1848.
Engraulis mystacoides, Günther, Cat. Fishes, VII, 396, 1867.

(It is unfortunate that there is another species of this genus named *purava*).

Two specimens, 4 inches long.

Head 4 and 4⅓, depth 4, eye 4 and 4⅓ ; scales 42 ; B. 9 or 10 ; D. 13 ; A. 40 ; P. 12 and 13 ; V. 8 ; gill-rakers 13.

Dorsal nearer caudal than snout, its last rays over origin of anal ; pectorals reaching nearly to the tips of ventrals, which are small. 25 spiny scutes on abdomen, extending forward to the gill opening. Snout very short, about ¾ of eye, projecting but little beyond lower jaw. Maxillary not quite reaching pectoral, pointed with teeth on full length. Most anterior teeth of jaws strongly hooked backward, others nearly straight but inclined slightly forward. Small or minute teeth on palatines, pterygoids, gill-arches and hyal bones ; two patches each on vomer and palatines, those of the vomer somewhat enlarged. Gill-rakers coarse, spiny, shorter than eye.

Trichosoma adelæ Rutter. New species.

Eight specimens, 5 inches long ; No. 1,565, Leland Stanford Junior University.

Head 4½, depth 3⅔ to 4, eye 3⅔ to 4 ; scales 40 ; B. 12 ; D. 11 to 12 ; A. 39 to 41 ; P. 14 ; V. 7 ; gill-rakers 20.

Dorsal short, its depth twice length of base, the last four rays especially weak and short, its origin very slightly nearer caudal than snout. Origin of anal under last ray of dorsal, pectorals reaching middle of ventrals. Twenty-five scutes on abdomen. Maxillary pointed, extending beyond base of pectorals, with teeth on its full length. Teeth in both jaws equal in size, those on the palatine slightly enlarged, in two patches, but minute, on gill-arches, but none on hyal bones, broad oval patches on palatines, present on pterygoids. Snout very short, 5⅔ of eye, projecting but little beyond lower jaw. Gillrakers very thin and closely set, shorter than eye, edge rough. Sides silvery, back flesh color (in alcohol), black punctulation on scapular region.

This species is most closely related to *Trichosoma porava* (Bleeker), with which it is found. It differs in having fewer dorsal rays and *more gill-rakers*, characters by which it differs from all other species

of *Trichosoma*, so far as I can determine. There are no teeth on the hyal bones, the maxillary is more produced, the eye larger, and there are no punctulations on lower side of head.

I take pleasure in naming this species for Miss Fielde.

Trichosoma hamiltonii (Gray).

Thrissa hamiltonii Gray, Ind. Zool., 1830–4.
Trichosoma hamiltonii, Swainson, Fish, etc., II, 292, 1839.
Engraulis hamiltonii, Günther, Cat., VII, 395, 1868.

Recorded by Sauvage.

Coilia mystus

Mystus mystus (Linnæus).

Clupea mystus Linnæus in Osbeck, Iter., p. 256 (*Günther*).
Mystus clupeoides, Lacépède, V, 467, 1803.
Coilia clupeoides, Günther, Cat. Fishes, VII, 404, 1867.

Several specimens, 6 to 7 inches long.

Head 5¾, depth 5½, eye 4½; scales about 58; B. 10; D. 12 or 13; A. about 80; gill-rakers about 28.

Body regularly tapering from dorsal to tip of caudal, snout projecting half its length beyond lower jaw, eye equal to or very slightly less than snout. Mandible 1⅔ in head, maxillary to below root of pectoral. Teeth on maxillary becoming larger and farther apart posteriorly, but somewhat worn off on the free portion. Teeth of lower jaw in a single series, imbedded in the gums; two small, widely separated patches of strong teeth on vomer, a single row on palatines, none on hyoid arch. Base of dorsal high anteriorly, a

SALANGIDÆ.

Salanx chinensis (Osbeck).

Albula chinensis Osbeck, Reise in China, Rostock, 309, 1765 (*Günther*).
Salanx chinensis, Günther, Cat., VI, 205, 1866.

Four specimens, 3½ to 6 inches long.

Head 4⅗, eye 7½; D. 10; A. 25; P. 12; V. 7.

The stomach is seemingly capable of considerable dilation; a row of small black specks along the side of the belly. One specimen has at the base of the anal fin a peculiar enlargement of the muscles, which is bounded above by a line of pores. It also has some black coloring about the pectorals and occiput. Scales of all specimens entirely deciduous.

Salangichthys microdon Bleeker.

Salangichthys microdon Bleeker, Act. Soc. Sc. Indo-Nederl., VII, Japan, VI, p. 100 (*Günther*).
Salanx microdon, Günther, Cat., VI, p. 206, 1866.

Three specimens, less than 3 inches long.

Head 6, eye 4½; D. 13; A. 24; P. 18; V. 7.

Teeth small, in a single row in each jaw, none on tongue, vomer or palatines. Head abruptly narrowed in front of the eyes, much depressed, the depth at eyes being about half the width. Edge of maxillary serrate. Origin of dorsal about midway between eyes and tip of caudal; tip of ventrals scarcely reach to below origin of dorsal, about half way to anal, webs very broad; origin of anal behind tip of dorsal; adipose fin above hinder part of anal. Anterior rays of anal much longer than posterior. Basal half of pectorals fleshy, spreading, fan-shaped, the naked rays projecting from the margin like fingers. The whole fin less than half as long as ventrals, 18 to 24 ray division beyond the fleshy part. Scales entirely deciduous.

SYNODONTIDÆ.

Harpodon nehereus (Buchanan Hamilton).

Osmerus nehereus Buch. Ham., Fish Gang., 209 (*Günther*).
Harpodon nehereus, Günther, Cat. Fishes, V, p. 401, 1864; Day, Fishes of India, p. 505, pl. 118, fig. 1, 1888.

Two specimens, six inches long.

Head 4⅗, depth about 8, eye equal to snout; D. 13; A. 16; P. 10; V. 9.

Pectorals about reach ventrals, ventrals reach anal, dorsal inserted over ventrals, adipose dorsal over origin of anal, cleft of mouth equals distance from eye to pectoral. See Günther, Cat. V, p. 401.

Trachinocephalus limbatus (Eydoux & Souleyet).

Saurus limbatus Eydoux & Souleyet, Voy. Bonite, Poiss, p. 199, pl. 7, fig. 3.

Saurus myops, Günther, Cat. Fishes, V, 398, 1864.

One specimen, 6½ inches long.

Head 3½, depth 6, eye 5¼; scales 56; B. 12; D. 12; A. 15; P. 12; V. 8.

Body somewhat compressed, back not elevated at dorsal. Snout shorter than eye, lower jaw slightly projecting. Maxillary 1⅝ in head; distance from snout to hinder margin of eye 1⅓ in maxillary. Top of head and edge of post-temporal finely corrugated, interorbital deeply concave, very little over half of eye. Fully developed teeth all depressible. A new series of teeth seems to grow in the maxillary to replace those broken off. Gill-rakers replaced by small teeth. Seventeen scales before dorsal, very large elongated scales on caudal. Dorsal higher than long, its origin midway between snout and adipose fin, its base longer than maxillary; pectorals reach middle of base of ventrals, and to tenth scale of lateral; base of ventrals oblique, the two meeting and forming a V-shaped area covered by rather large scales, some rather large scales in axil of ventrals; ventrals nearly reach vent; origin of anal under tip of depressed dorsal, tip of anal almost reaches caudal, base of anal equals head without snout. Sides with two stripes about a scale wide, and two narrower. Top of head with dark vermiculations;

ESOCIDÆ.

Tylosurus strongylurus (Bleeker).

Mastacembelus strongylurus Bleeker, Ned. Tidschr. Dierk. III, 1863 (*Günther*).
Belone strongylurus, Günther, Cat. Fishes, VI, 246, 1866; Day, Fishes of India, p. 512, pl. 118, fig. 6, 1888.

Three specimens, 11 in. long.

Head 3, D. 14; A. 17; P. 11.

As described by Günther, Cat. Fishes, VI, 246.

Eye equals interorbital space 3 in postorbital part of head. Lower jaw slightly projecting, with fleshy tip. Depth 1½ in length of pectoral; pectoral equals postorbital part of head. Ventral nearer head than caudal. Caudal truncate or slightly rounded.

HEMIRAMPHIDÆ.

Hyporhamphus sinensis (Günther).

Hemirhamphus sinensis Günther, Cat. Fishes, VI, 265, 1866.

One specimen, 6 inches long.

Head 2¾, depth 9; D. 15; A. 15; P. 11.

OPHICEPHALIDÆ.

Ophicephalus maculatus (Lacépède).

Bostrychus maculatus Lacépède, Hist. Nat. Poiss., III, pp. 140, 143, 1802.
Ophiocephalus maculatus, Cuvier & Valenciennes, 7, 437, 1831; Günther, Cat. Fishes, III, 480, 1861.

One specimen, 7½ in. long.

Head 3⅛, depth 5⅓, eye 7; scales 6–56–12; D. 44; A. 30.

Channa ocellata Peters.

Channa ocellata Peters, Monatsber. Acad. Wiss. Berl., 1864, 392.

Head 3¾, depth 6½, eye 5; D. 45; A. 29; scales 6–56–11.

All teeth in lower jaw about equal in size, in a single series, except in front, where they form a band. Teeth in two series on palatines, two or three on vomer, and in a band in upper jaw. Eye equal to snout. Interorbital nearly flat, its width 3¾ in head. Maxillary extending beyond orbit, 2⅕ in head. Preorbital very narrow, its narrowest portion about as wide as maxillary. A short barbel, ⅓ length of eye, on each side of snout. Scales on top of head rather large, ⅔ diameter of eye, seven scales between eye and angle of preopercle. A simple accessory respiratory organ without very well developed closing membranes, there being only a slight fold from opercle to upper part of first gill arch, and a process from one of the suspensory bones and a small process from the gill

arches. Union of gill membranes in middle of length of head. A broad shallow groove in front of dorsal. Origin of dorsal over second scale behind pectoral, pectoral extending $\frac{2}{3}$ of distance to anal, origin of anal midway between snout and base of caudal. End of dorsal farther posterior than that of anal, last rays of dorsal reaching for half their length over caudal. Pectoral equals post-orbital part of head. Caudal rather pointed, its length $4\frac{3}{4}$ in that of body. Ventrals wanting. Tail from anal equals one-half its depth, which is over half that of the body. Scales with rather wavy concentric striæ, lateral line decurved and interrupted over origin of anal. Color, in alcohol: Sides with about a dozen cross stripes each bent with the angle forward, dorsal dark, anal edged with black, dark above, belly washed with black, a dark blotch on upper side of head and a dark stripe backward from eye. A black ocellus at base of caudal.

This species is readily distinguished from *orientalis* by the greater number of fin rays and scales and by the two rows of teeth on the palatines.

The above description is based on one specimen, $5\frac{1}{2}$ in. long.

FISTULARIIDÆ.

Fistularia serrata Cuvier.

Fistularia serrata Cuvier, Règne Animal, Poiss., 209, 1829; Günther, Cat. III, 533, 1861; Day, Fishes of India, 360, pl. 76, fig. 3, 1888.

[redacted]

Head 3½, depth 4, eye 3⅓; scales about 30; D. IV–I, 8; A. III, 9.

Agrees in every respect with the description gven by Günther.

POLYNEMIDÆ.

Polydactylus tetradactylus (Shaw).

Polynemus tetradactylus Shaw, Zool., V, 155, 1819; Günther, Cat. Fishes, II, 329, 1860; Day, Fishes of India, p. 180, 1888.

One specimen, 7 inches long.

Head 3½, depth 4, eye 5; scales 89; D. VIII–I, 15; A. III, 15.

Longest rays of soft dorsal much longer than its base, all reaching past end of fin; longest rays of anal about equal to its base, some falling short of end of fin. Pectoral filaments four, scarcely reaching past base of ventrals. Upper caudal lobe slightly longer, middle caudal rays less than one-third length of lobes. First dorsal spine very short, about equal to length of adjacent scales. All fins, but spinous dorsal, finely scaled. Scales minutely granulose and toothed, lateral line extending on to lower caudal lobe, not on upper. Tail deep and compressed, its width 2½ in depth at middle point between anal and caudal. Preopercle finely serrate, the serræ becoming slightly larger downward. Scales deciduous on opercle, which is finely striate. Teeth on mandible even on outer side. No air bladder; very numerous small pyloric cocca.

MULLIDÆ.

Upeneoides bensasi (Schlegel).

Mullus bensasi Schlegel, Fauna Japonica, p. 30, p. XI, fig. 3, 1847.
Upeneoides bensasi, Günther, Cat. Fishes, I, 399, 1859; Day, Fishes of India, p. 121, pl. 30, fig. 5, 1888.

Three young specimens, 4 inches long.

Head 3½, depth 4½, eye 3¼; scales deciduous, 25 or 30; D. VII, 9; A. 7, P. 14.

Eye 1⅓ in snout, interorbital equal to vertical diameter of eye, maxillary reaching vertical from anterior margin of orbit. Vomerine teeth in two diverging oblong patches connected by a single series, all other teeth in narrow bands. Barbels reaching past preoperculum, about to middle of operculum. Height of dorsal equals depth of body; origin of anal under third or fourth ray of dorsal. Length of ventral equal to head without snout; pectoral long, reaching past tip of ventral, about to tip of depressed dorsal.

One would expect to find *Upeneoides tragula* in this territory, but the specimens more nearly agree with the above.

Mulloides flavolineatus (Lacépède).

Mullus flavolineatus Lacépède, III, 406.
Mulloides flavolineatus, Günther, Cat. I, 403, 1859; Day, Fishes of India, 122, pl. 30, fig. 6.

Recorded by Sauvage.

SCOMBRIDÆ.

Scomberomorus guttatus (Bloch & Schneider).

Scomber guttatus Bloch & Schneider, p. 23, 1801.
Cybium guttatum, Günther, Cat. Fishes, II, 371, 1860.

One specimen.

Head 4, depth $4\frac{2}{5}$, eye $4\frac{1}{4}$; D. XVI, 20, VIII; A. 21, VII.

TRICHURIDÆ.

Trichiurus japonicus (Schlegel).

Trichiurus lepturus japonicus Schlegel, Fauna Japonica, 102, pl. 54, 1847.
Trichiurus japonicus, Günther, Cat. Fishes, II, 347, 1860.

One specimen, 32 inches long.

Head 8, depth 17, eye $5\frac{1}{8}$.

Depth a little less than half of head; eye a little over half snout, greater than interorbital which is very slightly concave. Lower jaw longer, upper jaw fitting behind the two lower front teeth. Anterior teeth of lower jaw 'and the four larger ones of the upper jaw barbed. Lateral line descending behind head, extending thence parallel with ventral surface. Spines of anal very rudimentary, [redacted]

Caranx malabaricus (Bloch & Schneider).

Scomber malabaricus Bloch & Schneider, 31, 1801.
Caranx malabaricus, Günther, Cat., II, 436; 1860; Day, Fishes of India, 221.

Recorded by Sauvage.

Trachurops crumenophthalmus (Bloch).

Scomber crumenophthalmus Bloch, pl. 343.
Caranx crumenophthalmus, Günther, Cat., II, 429, 1866; Day, Fishes of India, 217, pl. 49, fig. 1, 1888.

Recorded by Sauvage.

LEIOGNATHIDÆ.

Leiognathus nuchalis (Schlegel).

Equula nuchalis Schlegel, Fauna Japonica, 126, pl. 67, fig. 1, 1847; Günther, Cat. Fishes, II, 500, 1860.

Three specimens, 3 inches long.

Head $3\frac{2}{5}$, depth $2\frac{1}{6}$, eye 3; D. VIII, 16; A. III, 14.

STROMATEIDÆ.

Stromateoides argenteus (Bloch).

Stromateus argenteus Bloch, XII, 83, pl. 421, 1797.
Stromateus argenteus, Günther, Cat. Fishes, II, 400, 1860.

One specimen, four inches long.

Head $3\frac{1}{2}$, depth $1\frac{1}{2}$, eye 3; D. VIII, 44; A. VI, 39.

Eye larger, longer than snout, $\frac{1}{2}$ depth of gill opening. Pectoral $2\frac{1}{2}$ in body, dorsal lobe and upper caudal lobe equal to pectoral, anal lobe $2\frac{1}{4}$ in body. Cleft of mouth to vertical from margin of eye. Opercle weak, with prominent radiating striæ. Lateral line not developed as far as origin of soft dorsal. Ventrals wanting. Origin of soft dorsal behind pectoral, over third anal spine. Silvery below, silvery gray above, dorsal shaded with dark.

Stromateus niger (Bloch).

Stromateus niger Bloch, pt. XII, 85, pl. 422; Günther, Cat., II, 401, 1860; Day, Fishes of India, 247, pl. 53, fig. 4, 1888.

Recorded by Sauvage.

SERRANIDÆ.

Epinephelus tauvina (Forskål).

Serranus crapao Cuv. & Val., III, 494.

Recorded by Sauvage as *Serranus crapao*.

Lateolabrax japonicus (Cuvier & Valenciennes).

Serranus pœcilonotus Schlegel, Fauna Japonica, Poiss., 6, pl. 4 A., fig. 1, 1847; Günther, Cat., I, 155, 1859.
Percolabrax pœcilonotus, Sauvage, op. cit.

Reeorded by Sauvage.

Glaucosoma fauvelii Sauvage.

Glaucosoma fauvelli Sauvage, Bull. Soc. Philom. (7), V, 1881, 104 (Swatow).

PRIACANTHIDÆ.

Priacanthus tayenus Richardson, Ich. Seas of China, p. 237 (*Gunther*); Günther, Cat., I, 221, 1839.

Recorded by Sauvage.

LUTIANIDÆ.

[1]**Lutianus vitta** (Quoy & Gaimard).

Mesoprion vitta Quoy & Gaimard, Voy. de Freycinet, Zool., Poiss., 315, pl. 58, fig. 3, 1824–1827 (*Günther*); Günther, Cat., I, 207, 1859.

Diacope vitta, Schlegel, Fauna Jap., 13, pl. 6, fig. 1, 1847.

Lutjanus vitta, Bleeker, Atl. Ichth., Perc., VIII, 51, pl. 340, fig. 5; Day, Fishes of India, 46, pl. 14, fig. 2, 1888.

One specimen, 5½ inches long.

Head 2¾, depth 2⅜, eye 3½; scales 7–52–14; D. X, 13; A. III, 7.

Preoperculum finely denticulated, a black band extending from eye to upper base of caudal (rather indistinct posteriorly, in alcoholic specimen, but black anteriorly); an enlarged blotch in this band under last rays of spinous dorsal; caudal emarginate middle rays to outside rays as 4 : 5; dorsal with ten spines. Eye equal to snout, interorbital 1½ in orbit. Lower edge of eye on a line drawn from tip of opercle to lower edge intermaxillary. About 10 teeth on lower limb of preopercle and 43 on upper, those at the angle larger. Upper limb very slightly emarginate, and the notch over interoper-

anal, equal to second dorsal. A slight sheath at base of both dorsal and anal. Scales and lateral line extend about one-third the length of the caudal. The rows of scales above the anterior part of the lateral line are parallel with it, but as the lateral line curves downward they curve slightly upward until, near the end of dorsal, there is quite a strong angle between them. Narrow black stripes along each row of scales above the black band and along three or four rows below it. Cheeks silvery, (alcoholic). Bleeker gives an excellent plate of this species.

Lutianus johnii Bloch.

Anthias johnii Bloch, tab., 318.
Mesoprion johnii, Günther, Cat., I, 200.

Recorded by Sauvage.

HÆMULIDÆ.

Pomadasis hasta (Bloch).

Lutjanus hasta Bloch, Ichthyologia, pt. 7, p. 87, pl. 246, 1897.
Pristopoma hasta, Günther, Cat. Fishes, I, p. 289, 1859; Day, Fishes of India, p. 73, pl. 19, 1888.

Two young specimens, 4½ inches long.

Head 3; depth 2⅝; eye 3⅔; scales 7–47–10. D. XII, 14; A. III, 8.

Well described by Günther, Cat. Fishes, I, p. 289. Scales of lateral line very small, second anal spine equal to fourth dorsal. Pectorals inserted under origin of dorsal, the ventrals but little behind. Origin of anal under last dorsal spine. Ventrals reach almost to vent. Scales forming sheaths on each side of the dorsal and anal fins. Maxillary to below anterior margin of eye.

THERAPONIDÆ.

Therapon jarbua (Forskål).

Sciæna jarbua Forskål, Descr. Ainim., p. 5, 1775.
Holocentrus servus, Bloch, tab., 238, pat. 7, p. 61.
Therapon servus, Günther, Cat., I, p. 278, 1859.
Therapon jarbua, Day, Fishes of India, p. 69, 1888.

Four specimens, 3½ to 5½ inches long.

Head 3; depth 3; eye 4; lat. l. 100. D. XI–I, 10; A. III, 8.

Therapon oxyrhynchus Schlegel.

Therapon oxyrhynchus Schlegel, Fauna Japonica, 16, pl. VI, fig. 3, 1847; Günther, Cat. Fishes, I, 281, 1859.

Three specimens, 3 inches long.

Head 3; depth 3; scales 60. D. XII, 10; A. III, 8.

The specimens do not differ from the description given by Günther, Cat. Fishes, I, 281.

SPARIDÆ.

Pagrus cardinalis (Lacépède).

Sparus cardinalis Lacépède, IV, 141 (*Günther*).
Pagrus cardinalis, Günther, Cat., I, 470, 1859.

Lethrinus richardsonii Günther.

Lethrinus richardsonii Günther. Cat. I, 456, 1859 (Hong Kong).

Synagris celebicus (Bleeker).

Dentex celebicus Bleeker, Celebes, V, p. 245 (*Günther*).
Synagris celebicus, Günther, Cat., I, 377, 1859.

Chrysophrys aries Schlegel. Schlegel, Fauna Japonica, Poiss., 67, pl. 31, 1847; Günther, Cat. I, 489.

GERRIDÆ.

Gerres japonicus Bleeker.

Gerres japonica Bleeker, Japan, 404 (*Günther*); Günther, Cat., IV, 260, 1862.

One small specimen, 3¼ inches long, probably belongs to this species.

Head 3⅓; depth $2\frac{2}{5}$; eye 2¾; scales about 34. D. IX, 10; A, III, 7.

Scales deciduous, at least 34; no filaments to any of the spines. First dorsal and anal spines very short, the second of each fin heaviest and the third longest. Longest dorsal spine 2¼ in depth of

Collichthys lucidus (Richardson).

Sciæna lucida Richardson, Ich. Voy. Sulph., 87, pl. 44, figs. 3 and 4.
(Not *Collichthys lucidus* Günther, Cat., II, 312, 1860, which was based on a young specimen of *C. biauritus*. See Zoological Record, 1866, p. 143).

Two specimens, 3 and 6 inches long.

Head $3\frac{1}{2}$; depth $3\frac{1}{3}$; eye $5\frac{1}{2}$. D. VIII–I, 23; A. II, 12.

Lepidozygus

POMACENTRIDÆ.

Pomacentrus jordani Rutter, new species.

One specimen, $4\frac{1}{4}$ inches long; No. 1,760, Leland Stanford, Jr., University Museum.

Head $3\frac{1}{2}$; depth $2\frac{1}{2}$; eye $2\frac{4}{5}$; scales 6–44–10. D. XIII, 13; A. II, 13; P. 18.

Profile steep, regularly arched, snout short and blunt, a little over half length of eye. Eye a little greater than interorbital width. Preorbital narrow, the anterior side emarginate, without serrations, its width in middle one-third its length which is two-thirds of eye. Teeth compressed in a single series, quite small on side of jaw, becoming larger anteriorly, the six front ones in each jaw incisors with a central cusp which, in the single type specimen, is brownish. Maxillary very oblique, extending past vertical from front of eye. Head entirely scaly except between and in front of eyes, four rows of scales on cheeks. Interorbital transversely convex. Vertical limb of preopercle very finely serrated, the serrations a little larger at angle, none on lower limb. Opercle with two weak spines, the upper one notched. Origin of dorsal over beginning of lateral line and upper end of gill-opening. Soft portion scaly at base, the spinous portion in a groove, the fourth and fifth spines longest. Origin of anal under tenth or eleventh dorsal spine, the soft portion scaly, the spinous portion in a groove. The last dorsal and anal rays reach base of anal. Pectorals somewhat tapering, equal to length of head without snout. Ventrals nearly as long as pectorals, but not reaching anal. Caudal deeply forked, the lobes slightly filiform. the upper longer than lower, which is equal to length of head. Least depth of caudal peduncle equal to half its length. Lateral line creasing under fourth soft ray of dorsal, with 30 scales, the portion in middle of tail represented on one side only, and that by one or two pores. Color, in alcohol: Olive, scales above lateral line with pale edges, those below with indications of light lines along each row; a deep black spot at upper base of pectoral, which is otherwise colorless; dorsal and anal with dark edges, middle rays of caudal and ventrals tinged with black.

This species is most closely related to *Pomacentrus jerdoni* Day, differing from it in the number of scales and in the anterior outline of head.

LABRIDÆ.

Iniistius pavo (Cuvier & Valenciennes).

Xyrichthys pavo Cuv. & Val., XIV, 61, 1839.
Novacula pavo, Günther, Cat., IV, 175, 1862.

Recorded by Sauvage.

DREPANIDÆ.

Drepane punctata (Gmelin).

Chætodon punctatus Gmelin, p. 1243, 1774.
Drepane punctata, Günther, Cat. Fishes, II, 62, 1860; Day, Fishes of India, 116, 1888.

Two specimens, $2\frac{1}{2}$ inches long.

Head $2\frac{3}{4}$; depth (from origin of dorsal to origin of anal) 1; Eye 3 in head; scales 19 or 20–46–34 to 37. D. VIII, 21; A. III, 18; P. I, 16.

Owing to the differences between young and old individuals, I give the following extended description, which is based on the young: Dorsal with eight movable spines, in front of which is a very rudimentary immovable one set at right angle to the first movable spine (when elevated), and a sharp hidden spine directed forward. Dorsal with a broad, shallow notch separating the two [redacted]

arched, a supplemental line curving from above opercle to the rudimentary spines at occiput. Scales cycloid except those on upper side of head. Seventeen barbels on under side of head, symmetrically arranged in one specimen, not quite so in the other, the anterior eight being in two transverse rows, those of the second row wider apart; and the posterior eight in four pairs. Color, in alcohol, silvery, with two indistinct vertical bars on side.

SCATOPHAGIDÆ.

Scatophagus argus (Gmelin).

Chætodon argus Gmelin, 1248.
Scatophagus argus, Günther, Cat., II, 58, 1860.

Recorded by Sauvage.

SIGANIDÆ.

Siganus albopunctatus (Schlegel).

Amphacanthus albopunctatus Schlegel, Fauna Japonica, Poiss., 128, 1847.
Teuthis albopunctata, Günther, Cat. Fishes, III, 318, 1861.

Three specimens, 5 inches long.

Head 4; depth 2⅝; eye 2¾. D. I–XIII, 10; A. VII, 9.

Maxillary to below posterior nostril. Origin of dorsal over gill opening. Free spine in front of dorsal sagittate. Dorsal spines after the first, placed alternately on the right and left sides; the fourth the longest, equal to half depth of body at origin of dorsal. Spines of anal alternating like those of dorsal, third and fourth equally longest. Ventral spines reaching front of pubic bones. Pectoral a little longer than half greatest depth of body. Least depth of tail half its length, spreading at base of fin. Caudal forked, proportion of longest and shortest rays 3 : 2. Color, in alcohol, reddish-brown above, gradually changing to silvery on belly, brown spot above pectorals not very distinct, a more or less distinct narrow line of darker brown along back near base of dorsal fin, numerous small elliptical white or silvery spots along sides which are usually farther apart than the larger diameter.

TRIACANTHIDÆ.

Triacanthus brevirostris Schlegel.

? *Balistes biaculeatus* Bennett, Fish, Ceylon, pl. 15, 1841.
Triacanthus brevirostris, Schlegel, Faun. Jap., p. 294, pl. 129, f. 2, 1847.
Triacanthus nieuhofi, Bleeker, All. Ich., V, p. 292, 217, f. 3, 1865.
Triacanthus brevirostris, Günther, Cat. Fishes, VIII, 209, 1870; Day, Fishes India, 685, 1888.

One specimen, 9 inches long.

Head 3½, depth 2¾, eye 3¾; D. IV–22; A. 18.

MONACANTHIDÆ.

Monacanthus sulcatus Hollard.

Monacanthus sulcatus Hollard, Ann. des Sci. Nat., 4th Series, Zool., tom. 2, p. 363, pl. 14, fig. 11; Günther, Cat., VIII, 239.

Three specimens, 3½ to 4 inches long.

Head 3⅓, depth 2¼, eye 3; D. I–33; A. 33; C. 12.

Profile between the dorsal fins but little oblique, the origin of the second dorsal being scarcely higher than the anterior fins. Upper and lower profiles of head nearly straight, forming an angle of a a very little over 60°. Dorsal spine over hinder part of orbit, its length equal to the distance from end of snout (not tip of teeth) to middle of eye, shorter than caudal, longer than the longest dorsal or anal rays. It has two rows of strong barbs on the outer hinder edges, about a dozen in each series, and an anterior double series of small barbs. The rudiment of a second dorsal spine is covered by the skin. Ventral spine short, half length of eye, movable, granulose, with four barbs at tip, two pointing forward and two backward. The pubic bone projects beyond the dermal flap, granulose, provided with eight barbs, four at base pointing forward, and four at tip, the two larger pointing forward and the two smaller backward. Dorsal slightly anterior to anal. Rays of pectoral and posterior rays of dorsal and anal webbed only for the basal third of their length, the web on dorsal and anal becoming higher anteriorly. Caudal rays [redacted]

These specimens differ from the description of this species as given by Günther, Cat. Fishes, VIII, p. 246, in having barbs on the front of the dorsal spine; but these may be lost with age.

TETRAODONTIDÆ.

Lagocephalus lunaris (Bloch & Schneider).

Tetrodon lunaris Bloch & Schneider, 505, 1801; Günther, Cat., VIII, 274, 1870; Day, Fishes of India, 701, pl. 182, fig. 2, 1888.
Tetraodon lunaris, Schlegel, Fauna Japonica, Poiss., 277, pl. 122, fig. 1, 1847.

One specimen, 6 inches long.

Head 3, depth 3½, eye 3¾; D. 11; A. 10.

Lips covered with cirri.

SCORPÆNIDÆ.

[1] **Trachicephalus uranoscopus** (Bloch & Schneider).

Synanceia uranoscopa Bloch & Schneider, 195, 1801 (plate).
Polycaulus elongatus, Günther, Cat. Fishes, II, 175, 1860.
Polycaulus uranoscopus, Day, Fishes of India, p. 164, pl. 37, fig. 6.

Six specimens, 3 inches long.

Head 4, depth 3⅗, eye 4½; D. 10 to 13; A. 15.

Eye equals snout, 1½ in interorbital. Maxillary to below front margin of eye. A blunt preorbital spine; four blunt spines along preopercle, two on opercle. Numerous irregular ridges on head. Gill-opening continuous with a small, round opening above opercle, which is closed by a dermal flap. Teeth weak, villiform, in bands. All fins covered with skin. Dorsal beginning between anterior edges of superior gill-openings, the web very full between the anterior spines so that the anterior one may be raised perpendicular or even pointed anteriorly; fin low, spines flexible. Pectorals rounded, longer than head; ventrals attached by entire inner edge to abdomen; caudal nearly truncate, slightly rounded, tips of rays projecting. No scales. Mucous pores in a series of small papillæ along side of back, these light in color and extending onto caudal; also a series of pores along base of anal. Color (in alcohol), dark brownish, with white dots, fins with black edges, in most specimens the caudal has a white tip and a white blotch on the upper and lower edges.

Apistus alatus Cuvier & Valenciennes.

Apistus alatus Cuv. & Val., IV, p. 392, 1829; Schlegel, Fauna Japonica, Poiss., 49, 1847; Günther, Cat., II, p. 131, 1860.

Three specimens, 4 to 5½ inches long.

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[1] The generic name *Trachicephalus* may be retained instead of *Polycaulus*, as the earlier *Trachycephalus* is differently spelled.

Head 3, depth $3\frac{2}{3}$, eye 4; D. XV, 8; A. III, 6; P. 10–1; V. I, 5. Scales deciduous, about 55 or 60 in the lateral line, each with three teeth. Lateral line high, extending backward from a ridge on the side of the head. Upper rays of pectoral reach about to caudal, one pectoral filament which reaches tip of ventral. Dorsal continuous, but with a notch in front of soft portion. Preopercle with a sharp spine above the angle, spines of opercle undeveloped. Preorbital with three spines: one directly forward, short and rather blunt; one extending downward, small and sharp; one extending backward, large and strong, extending three-fourths of distance to end of maxillary. Between the intermaxillaries is a notch without teeth, the slightly projecting tip of the lower jaw fitting into it. Teeth of vomer in two small oval patches connected anteriorly by a narrow band of very small teeth. Slit behind last gill, small. Two low sharp ridges on top of head behind eye, intraorbital space concave, with a narrow groove in the middle. Opercle and suborbital with small radiating ridges. Three barbels on lower jaw. Black blotch of dorsal on ninth to twelfth spines, soft dorsal with dark streaks; pectoral and anal blackish; a whitish blotch in front of dorsal (in alcohol).

Pterois volitans (Linnæus).

Gasterosteus volitans Linnæus, Ed. XII, Syst. Nat., 491.
Pterois volitans, Günther, II, 122, 1869; Day, Fishes of India, 154.

the lower opercular. Tip of maxillary under middle of eye. Anterior part of lateral line spinous. Ventrals reach past origin of anal, their ends black, but the tips white. Other fins with black spots, a black blotch at base of caudal, lower half of pectoral black. (Color notes from alcoholic specimens).

Platycephalus asper Cuvier & Valenciennes.

Platycephalus asper Cuvier & Valenciennes, IV, 257, 1829; Schlegel, Fauna Japonica, Poissons, p. 40, pl. 16, fig. 4, 5, 1847; Günther, Cat. Fishes, II, 190, 1860.

One specimen, 6½ inches long.

Head 2¾ (3 in total), depth 6½, eye 3½; scales 55; D. I, VIII, 11; A. 11.

Snout broad and flat, scarcely shorter than eye; interorbital, deeply grooved, narrow, 4½ in snout. Tip of maxillary under middle of eye. Preopercle with three spines at angle, the upper much the larger, about half as long as snout, the lower very short and blunt. Opercle with two spines, widely separated, the lower larger, about the size of the middle preopercular spine. Interopercle with a strong spine directed forward. A small spine in front of eye, and a short, heavy scapular spine. All ridges of head, excepting that of the preopercle and opercle, finely serrate; the opercular ridge with a series of small spines on each side. Nostrils with short tubes. Ventral fins reach origin of anal. All fins except anal and ventrals with cross series of black spots, lower half of pectorals almost entirely black, with white tips. Anal white, ventrals with black tips.

Platycephalus insidiator (Forskål).

Cottus insidiator Forskål, 25, 1775.
Platycephalus insidiator, Günther, Cat., II, 1860; Day, Fishes of India, 276.

Recorded by Sauvage.

TRIGLIDÆ.

Lepidotrigla burgeri (Schlegel).

Trigla burgeri Schlegel, Fauna Japonica, Poiss., p. 35, pl. 14, figs. 1 and 2, 1847; Günther, Cat. Fishes, II, 198, 1860.

One specimen, 5¼ inches long.

Head 3, depth 4¾; lat. l. 60; D. VIII, 16; A. 16.

Teeth of vomer very weak; triangular spine of preorbital sharp-pointed with finely serrate edges, as long as depth of eye. Interorbital broadly and deeply grooved. Opercle with a broad backward process, the end of which is emarginate and the corners Opercle with a broad dermal margin. Gill-opening ex

upper side of opercle. Scapular plate with a strong, sharp spine, about as long as preopercular spine. A broad, flat spine on each side of occiput reaching past origin of dorsal. Plates and spines of head and anterior edge of spine rough granulose. A series of spinous plates on each side of dorsal. All dorsal spines except the first with their ends about even when depressed. Scales of lateral line with four or five small radiating keels, these gradually diminishing to one posteriorly. Pectorals evidently black.

GOBIIDÆ.

Bostrychus sinensis Lacépède.

Bostrychus sinensis Lacépède, III, 141, pl. 14, fig. 2, 1802.
Eleotris sinensis, Günther, Cat. Fishes, III, 127, 1861.
Bostrichthys sinensis, Bleeker, Gobioides, Archiv. Néer., 1874, p. 301; Day, Fishes of India, p. 309, pl. 65, fig. 4, 1888.

Two specimens, 6 inches long.

Head 3½, depth 5⅓, eye 6½; D. VI-I, 11; A. I, 9.

Prionobutis serrifrons Rutter. New species.

One specimen, 3 inches long; No. 4,995, Leland Stanford Junior University Museum.

Differs from *Prionobutis caperatus* Cantor in having a nearly horizontal mouth and in having two series of serræ on snout in front of eye.

Head 3⅓, depth 4, eye 4¼; D. VI–I, 9; A. I, 8; scales 28–9.

[redacted]

brown, darker brown shadings on sides; spinous dorsal and ventrals nearly uniform dusky; soft dorsal and anal dusky with pale blotches across middle; caudal pale with dusky cross bars; pectoral slightly dusky, a black blotch near base, below middle rays, a white line at base, this broken toward lower end, a narrow white line descending irregularly from upper side of fin to and along outer side of black spot.

Triænophorichthys trigonocephalus Gill.

Triænophorichthys trigonocephalus Gill, Proc. Acad. Nat. Sci. Phil., 1859, 195; Günther, Cat., III, 89, 1861.

One specimen, 4 inches long.

Triænopogon barbatus (Günther).

Triænophorichthys barbatus Günther, Cat., III, 90, 1861.
Triænopogon barbatus, Bleeker, Syst. Nat. Gob. Arch. Néer., IX, 312.

Several specimens, the longest 4 inches long.

Gobius cyanomos Bleeker.

Gobius cyanomos Bleeker, Verhand. Batav. Genootsch., XXII, Bleenn. en Gob. 25 (Günther); Günther, Cat., III, 39.

Several specimens, 4 in. long.

Gobius ommaturus Richardson.

Gobius ommaturus Richardson, Voy. Sulph., Fishes, 146, pl. 55, figs. 1–4; Günther, Cat., III, 77.

Three specimens, 4 inches long.

Gobius giurus Buchanan Hamilton.

Gobius giurus Buch. Ham., Fishes Ganges, 51, pl. 33, fig. 15, 1822; Günther, Cat. Fishes, III, 21, 1861; Day, Fishes of India, 294, pl. LXVI, fig. 1, 1888.

Several specimens, the largest 6 in. long.

Head 3½, depth 5½, eye 5½ to 6; scales 32; D. VI–I, 9; A. I, 8.

Gobius hasta Bloch.

Gobius hasta Schlegel, Fauna Japonica, Poiss., 144, pl. 75, fig. 1, 1847; Günther, Cat., III, 78, 1861.

Recorded by Sauvage.

Gobius albopunctatus Cuvier & Valenciennes.

Gobius albopunctatus Cuv. & Val., XII, 57, 1837; Günther, Cat. III, 25, 1861; Day, Fishes of India, 294, pl. 63, fig. 7, 1888.

Recorded by Sauvage.

Gobius longicauda Steindacher.

Gobius longicauda Steindachner, S. B. Akad. Wien. C II, 1893, 234 (Swatow).

Gobius petersenii Steindachner.

Gobius petersenii Steindachner, S. B. Akad. Wien. C II, 1893, 234 (Swatow).

Tongue not notched. "Ctenogobius platycephalus J & E."

Ctenogobius giurinus.

~~Gobius~~ giurinus Rutter. New species.

A single specimen, 3 in. long, No. 4,990, Leland Stanford, Jr. University Museum, differs from *Gobius giurus* in the longer and more depressed snout, horizontal mouth with lower jaw not prominent, and larger scales in front of dorsal.

Head 3½, depth 6, eye 4; D. VI–9; A. 9; scales 28–9.

Body long, compressed posteriorly; head depressed, somewhat wider than high; profile evenly curved; eyes very close together, the interorbital not so wide as pupil; snout a little over ⅓ of head; jaws even, the premaxillary very broad on top of snout, its width half length of eye; mouth nearly horizontal, teeth all small, two rows in sides of upper jaw, one row in side of lower jaw, in a band in front of each, broader in lower, no canines; maxillary to below anterior margin of eye; head scaleless, but few scales on breast, 10 scales in front of dorsal; spinous dorsal as high as body, soft dorsal of same height, distance of last dorsal from caudal equals that of first dorsal from middle of eye; pectorals reach past ventrals, 1⅓ in head; ventrals 1½ in head; anal not so high as soft dorsal. Color, in alcohol, pale with five indistinct brown cross bars, a brown blotch at upper base of pectoral, a faint one at base of caudal, soft dorsal with numerous round dusky spots, caudal and anal minutely dusted with black, pectorals and ventrals colorless.

Chæturichthys stigmatias Richardson.

[redacted]

The other specimen, which seems to have been better fed, has the head a little broader and the eyes more nearly vertical, and *smaller teeth* in the outer row.

Apocryptes serperaster Richardson.

Apocryptes serperaster Richardson, Ichth. China, 206 (*Günther*); Günther, Cat. Fishes, III, 82, 1861; Day, Fishes of India, p. 300, pl. LXV, fig. 2.

Four specimens, 5½ in. long.

Head 5, depth 7½, eye 5½; D. VI–28.

Boleophthalmus pectinirostris (Gmelin).

Gobius pectinirostris Gmelin, p. 1200, 1774.
Apocryptes pectinirostris, Cuvier & Valenciennes, 12, 150, 1837.
Boleophthalmus pectinirostris, Günther, Cat. Fishes, III, 102, 1861; Day, Fishes of India, 308, 1888.

Several specimens, 4 in. long.

Head 3¾, depth 6, eye 6; D. V–25; A. 25.

Gobioides petersenii Steindachner.

Gobioides petersenii Steindachner, S. B. Akad. Wien. C II, 1893, 235 (Swatow).

Trypauchen vagina (Bloch & Schneider).

Gobius vagina Bloch & Schneider, 73, 1801.
Trypauchen vagina, Cuv. & Val., XII, 153, 1837; Günther, Cat. Fishes, III, 137, 1861; Day, Fishes of India, 320, pl. 68, fig. 2, 1888.

Several specimens, 6 in. long.

Head 6, depth 8½, eye about 8.

A good description by Day, l. c.

CEPOLIDÆ.

Cepola abbreviata Cuvier & Valenciennes.

Cepola abbreviata Cuv. & Val., X, 403, 1835.
Cepola abbreviata, Günther, Cat., III, 488, 1861; Day, Fishes of India, 324, pl. 68, fig. 4, 1888.

Recorded by Sauvage.

SILLAGINIDÆ.

Sillago sihama (Forskål).

Atherina sihama Forskål, 70, 1775.
Sillago sihama, Günther, Cat. Fishes, II, 243, 1860; Day, Fishes of India, p. 265, pl. LVII, fig, 3, 1888.

Four specimens, 5 inches long.

Head 3¾; depth 6½; eye 3⅔; scales 66. D. XI–I, 21; A. I, 22.

PLEURONECTIDÆ.

Paralichthys arsius (Buchanan Hamilton).

Pleuronectes arsius Buch. Ham., Fish Gang., 128 (*Günther*).
Rhombus lentiginosus, Richardson, Ann. & Mag. Nat. Hist., XI, 1843, p. 495.

Pseudorhombus russellii, Günther, Cat. Fishes, IV, p. 424, 1862.
Pseudorhombus arsius, Günther, l. c., p. 426; Day, Fishes of India, p. 423, 1888.

One specimen, 7 inches long, agrees with Richardson's minute description of *Rhombus lentiginosus*, except that the interoperculum has only the lower side curved instead of being oval, and the rays of the pectorals are without scales.

Head 3¾; depth 2¼; eye 5½; scales 84. D. 81; A. 61; P. I, 11; V. 7.

Pleuronichthys cornutus (Schlegel).

Platessa cornuta Schlegel, Fauna Japonica, Poiss, 179, pl. 92, fig. 1, 1847.
Parophrys cornuta, Günther, Cat. Fishes, IV, 455, 1862.

One specimen, 5½ inches long.

Head 4½; depth 2; eye 3. D. 75; A. 54.

The upper prominence of the lower eye is very large, forming a spine as large as the one at the end of the ridge between the eyes; the prominences of upper eye very indistinct. Lower eye more anterior. Lateral line scarcely curved. Dorsal begins on blind side, as far forward as anterior margin of pupil. Distance of dorsal from caudal is one-half of eye. Pectoral one-half of head, twice length of ventral. Pectoral on blind side, dark.

SOLEIDÆ.

Cynoglossus lineolatus Steindachner.

[redacted]

decurved, extending through middle of body, the upper on fourth row of scales from dorsal, the lower beginning at tip of snout, the upper behind eye, both extending to caudal. No lateral line on right side. Scales adherent, ctenoid on both sides, smaller anteriorly and near the fins. In alcohol uniform light yellowish-brown, the five longitudinal lines formed by the scale striation.

This species differs from other species of the genus in the absence of any lateral line on the blind side, and may prove to be different from *lineolatus*, which is described as having about ten fewer rays in the dorsal and anal.

Cynoglossus melampetalus (Richardson).

Plagusia melampetala Richardson, Ich. China, 281 (*Günther*).
Cynoglossus melampetalus Günther, Cat., IV, 496, 1862.

Recorded by Sauvage.

Cynoglossus trigrammus Günther. Günther, Cat. IV, p. 494, 1862.

Recorded by Sauvage.

Cynoglossus macrolepidotus (Bleeker).

Plagusia macrolepidota Bleeker, Verhand. Batav. Genootsch., XXIV, Pleuron, p. 25, 1852 (*Günther*).
Cynoglossus macrolepidotus, Günther, Cat. Fishes, IV, 496, 1862; Day, Fishes of India, p. 434, pl. 96, fig. 3, 1888.

Three specimens, 3½ to 4½ inches long.

Head 4½; depth 4½; lat. l. (behind head) about 55. D. 115; A 80.

Two nostrils, one at anterior end of interorbital space, the other tubular, near mouth, above tip of lower jaw. Angle of mouth (on eyed side) behind lower eye, the hinder margin of which is in middle of head. Front of lower eye under middle of upper, interorbital space ⅔ width of eye. Horizontal cleft of mouth nearly twice as long on left side as on right. Hook of upper jaw somewhat variable in the three specimens, but not extending to vertical from anterior margin of upper eye. Pectorals none. Right ventral with four rays on side of body; left ventral continuous with anal. Vent on right side above left ventral. Two lateral lines on left side, nine rows of scales between them (above gill-opening); the lower through middle of body, nearly straight, slightly arched above gill-opening; the upper along fourth row of scales (in middle of body) from dorsal, both extending from tip of snout to caudal. Only one lateral line on right side, through middle of body. Scales partly or entirely deciduous, smaller anteriorly and near the fins, those of

left side ctenoid, those of right side smooth, apparently larger. In alcohol, colorless, except opercles, which have a dark tinge owing to the black lining membrane of the gill-cavity.

Synaptura quagga Kaup.

? *Æsopia quagga* Kaup, Wiegm. Arch., 1858, 98 (*Günther*).
Synaptura quagga, Günther, Cat., IV, 485, 1862.

Two specimens, 3½ inches long.

Head 5; depth 2½; eye 4½; lat. l. 75. D. 66; A. 56; P. about 10; V. 4.

Pectorals rudimentary, placed at edge of gill-opening, upper edge of fins continuous with membrane at margin of opercles, thus forming short breathing tubes. Ventrals separate, slightly longer than pectorals. Vertical fins continuous, scaled. Scales not closely imbricated, each with 7 or 8 long spinules, lateral line straight. Upper edge of gill-opening slightly lower than tip of maxillary. Cleft of mouth horizontal in front of lower eye, abruptly turned downward at its anterior margin. Tip of maxillary below middle of lower eye. Upper eye about ⅓ of its length anterior to lower. No tube at nostril on blind side, that on eyed side about half as long as eye, its tip reaching front margin of eye. Color, in alcohol: Several narrow, dark cross-bars on head. Behind head, colors regularly arranged in cross-bands as follows: (a) A white band about four scales wide; (b) a dark band five scales wide, a light line running through its middle; (c) a white band three scales wide; then (b), (a), (b), (c), [redacted]

A COLLECTION OF FISHES MADE BY JOSEPH SEED ROBERTS IN KINGSTON, JAMAICA.

BY DAVID STARR JORDAN AND CLOUDSLEY RUTTER.

Rev. Joseph Seed Roberts, an English missionary resident in Kingston, Jamaica, has been, for the past two years, engaged in the collection of the fishes of that region. Through the generous interest of Mr. Timothy Hopkins, of Menlo Park, California, a large series of these fishes has been sent to the Museum of Leland Stanford, Jr. University. This collection was very carefully made, and reflects great credit on the intelligent interest of Mr. Roberts. The present paper consists of an annotated list of these species, the vernacular names recorded being those in use by the Jamaica fishermen, as given by Mr. Roberts.

The following species are described as new:

Rhinobatus stellio, Stolephorus robertsi, Stolephorus astilbe, Siphostoma robertsi, Chloroscombus ectenurus, Mycteroperca hopkinsi, Scarus emblematicus, Eupomacentrus diencæus, Chilomycterus antillarum.

GINGLYMOSTOMATIDÆ.

1. **Ginglymostoma cirratum** (Gmelin). Spotted Nurse Shark.

Squalus cirratus Gmelin, Syst. Nat., I, 1,492, 1788 (American Seas).
Ginglymostoma cirratum, Jordan & Evermann, Fishes of North America, 26.

GALEIDÆ.

2. **Scoliodon terræ-novæ** (Richardson). Tiger Shark.

Squalus (*Carcharias*) *terræ-novæ* Richardson, Fauna Bor. Amer., III, 289, 1836.
Scoliodon terræ-novæ, Jordan & Evermann, Fishes of North America, 43.

SPHYRNIDÆ.

3. **Sphyrna zygæna** (Linnæus).

Squalus zygæna Linnæus, Syst. Nat., Ed. X, 234, 1758 (Europe, America).
Sphyrna zygæna, Jordan & Evermann, Fishes of North America, 45.

RHINOBATIDÆ.

4. **Rhinobatus stellio** Jordan & Rutter, new species.

Disk triangular, its greatest width a little less than half the distance from snout to dorsal, and equal to distance from snout to a line connecting points of greatest width. Sides of disk straight, tip of snout rounded, posterior point of pectoral more broadly rounded

than snout. Length of snout equal to, or a little less than, half greatest width of disk, equal to distance between outer points of anterior gill-openings; interorbital width 4 to 4⅔ in snout, a little less than length of eyes and spiracle, but about equal to length of nostril; internasal width equal to orbit; spiracle one-third length of eye, a prominent curved papilla and a slight ridge in its posterior side. Anterior nasal valve with a long slender flap extending across the nostril; three broad flaps on posterior side. Rostral ridges separate for their entire length, width between them at base equal to width of spiracle. Mouth nearly straight, its width 2¾ in its distance from snout and equal to distance between inner folds on posterior side of spiracle. Eye 4½ to 5¼ in snout. Width of body at axil of pectorals 1⅓ in snout. Dorsal fins about equal in size and shape, the distance between them 2½ times base of first, the distance between the origins of the two fins equal to snout and about equal to distance from axil of pectoral to origin of first dorsal. Sides of tail with a conspicuous fold. Skin above with a fine uniform shagreen, nearly smooth below except near margins of the disk. A series of very small spines above eye and spiracle, one or two minute spines on shoulder girdle; the largest spines of body situated along median line of back, extending beyond first dorsal; no spine on snout, but in two of the three specimens there is a pair of minute spineless plates near its tip. Color: dusky brown above, about seven faint dusky bars on the side of the tail behind first dorsal, uniform pale [redacted]

DASYATIDÆ.

6. **Urolophus jamaicensis** (Cuvier). Maid.

Raja jamaicensis Cuvier, Règne Animal, II, 137, 1817 (Jamaica).
Urolophus jamaicensis, Jordan & Evermann, Fishes of North America, 80.

Three specimens about 9 in. long. Asperities confined to middle of disk, a few along upper edge of caudal fin.

7. **Dasyatis hastata** (De Kay). Kit.

Trygon hastata De Kay, N. Y. Fauna: Fishes, 373, pl. 65, fig. 214, ♀, 1842, (Rhode Island).
Dasyatis hastata, Jordan & Evermann, Fishes of North America, 83.

The collection contains also the tail of another species of *Dasyatis* which we cannot identify.

MYLIOBATIDÆ.

8. **Aetobatus narinari** (Euphrasen). Whippley.

Raia narinari Euphrasen, Vet. Ak. Nya Handl., 1790, XI, 217 (Brazil).
Aetobatus narinari, Jordan & Evermann, Fishes of North America, 88.

ANGUILLIDÆ.

9. **Anguilla chrysypa** Rafinesque.

Anguilla chrysypa Rafinesque, Amer. Month. Mag. & Crit. Rev., 1817, 120 (Long Island); Jordan & Evermann, Fishes of North America, 348.

MURÆNESOCIDÆ.

10. **Muraenesox savanna** (Cuvier).

Muræna savanna Cuvier, Règne Animal, Ed. 2, Vol. 2, 350, 1829 (Martinique).
Murænesox savanna, Jordan & Evermann, Fishes of North America, 360.

OPHICHTHYIDÆ.

12. **Ophichthus gomesii** (Castelnau). Sea Eel; Whip Snake Eel..

Ophisurus gomesii Castelnau, Anim. Amér. Sud., 84, fig. 2, 1855 (Rio Janeiro).
Ophichthus gomesii, Jordan & Evermann, Fishes of North America, 384.

MURÆNIDÆ.

13. **Lycodontis moringa** (Cuvier).

Muræna moringa Cuvier, Règne Animal, ed. II, 1829 (Bahamas, after Catesby).
Lycondontis moringa, Jordan & Evermann, Fishes of North America, 395.

The dark brown blotches nearly everywhere confluent and marked with small black dots; the white ground appearing as more or less disconnected reticulations, merely small blotches on tail, but confluent on lower jaw and throat where the brown spots are much smaller than the interspaces; edge of dorsal and anal white poste-

riorly ; narrow black lines radiating forward from gill-opening and backward from throat ; mouth inside pale above, spotted below anteriorly, black posteriorly ; pores of lower jaw in white blotches.

14. Lycodontis funebris (Ranzani).

Gymnothorax funebris Ranzani, Nov. Comm. Ac. Sc. Inst. Bonon., IV, 76, 1840 (Brazil).
Lycodontis funebris, Jordan & Evermann, Fishes of North America, 396.

According to Mr. Roberts, the large specimen here noted was "bronze green" in life.

15. Lycodontis ocellatus (Agassiz). Murray Eel.

Gymnothorax ocellatus Agassiz, Pisc. Brasil., 91, pl. 506, 1828 (Brazil).
Lycodontis ocellatus, Jordan & Evermann, Fishes of North America, 399.

ELOPIDÆ.

16. Tarpon atlanticus (Cuvier & Valenciennes). Tarpum.

Megalops atlanticus Cuvier & Valenciennes, Hist. Nat. Poiss., XIX, 1846, 398 (Gaudeloupe).
Tarpon atlanticus, Jordan & Evermann, Fishes of North America, 409.

17. Elops saurus (Linnæus). John Mariggle ; Bony Fish.

Elops saurus Linnæus, Syst. Nat. Ed. XII, 518, 1766 (Carolina) ; Jordan & Evermann, Fishes of North America, 410.

"Sometimes weigh 20 lbs."

ALBULIDÆ.

[redacted]

ENGRAULIDIDÆ.

22. Stolephorus perfasciatus (Poey).

Engraulis perfasciatus Poey, Memorias, II, 1860, 313 (Cuba).
Stolephorus perfasciatus, Jordan & Evermann, Fishes of North America, 441.

23. Stolephorus brownii (Gmelin). Anchovy Fry.

Atherina brownii Gmelin, Syst. Nat., 1397, 1788 (Jamaica).
Stolephorus brownii, Jordan & Evermann, Fishes of North America, 443.

24. Stolephorus robertsi Jordan & Rutter, new species.

Head 3 in length; depth 4; dorsal 14; anal 23; scales about 35; eye 4 in head; pectoral 2½; base of anal 1⅔; caudal 1½.

Body deep, strongly compressed, abdomen compressed to an edge. Head large, compressed, the snout rather sharp, projecting beyond lower jaw, a little shorter than eye; cheek triangular; opercle large; distance from lower angle of cheek to edge of opercle equal to distance from same point to posterior edge of eye; maxillary short, not reaching root of mandible, its end rounded; lower jaw not reaching beyond anterior edge of orbit; gill-rakers longer than eye, as long as orbit; origin of dorsal midway between base of caudal and front of eye; scales caducous.

Color translucent; head silvery, punctulate above; a silvery lateral band nearly as broad as eye; caudal with dark points, other fins colorless.

This species seems to be related to *Stolephorus opercularis*, but the lateral band is distinct and the opercle is shorter.

One specimen in the collection about 2 inches in length, No. 4,853, L. S. Jr. Univ. Mus.

25. Stolephorus astilbe Jordan & Rutter, new species.

Head 4⅓ in length; depth 4½ to 5; dorsal 12; anal 19 to 22; eye 3½ in head; pectoral 1⅘; base of anal 1⅙.

Body rather elongate, not greatly compressed; edge of belly moderately sharp. Head sharp; snout projecting beyond lower jaw, shorter than diameter of eye; tip of lower jaw reaching a little past anterior edge of orbit; maxillary reaching gill opening, its end tapering to a sharp point; eye longer than snout, nearly 2 in postorbital part of head; gill-rakers two-thirds eye; a slight keel on top of head.

Origin of dorsal midway between base of caudal and eye; scales caducous.

Translucent, head silvery; sides without lateral band, a dark spot on top of head, back with black points.

This species is similar to *Stolephorus brownii*, but more slender, head shorter, and lateral silvery stripe wanting.

Numerous specimens from 1½ to 3 inches in length. No. 4,854, L. S., Jr. Univ. Mus.

26. Stolephorus productus (Poey). Grubber Broad Head.

Engraulis productus Poey, Repertorio, I, 380, 1866; Günther, Cat., VII, 338.

Head 3¾ in length; depth 3½; dorsal 13; anal 32; scales 35; eye 4 in head; pectoral 1¾; caudal 1; base of anal ⅛ longer than head.

Body moderately elongate, compressed; ventral outline curved more than dorsal; snout short, about half eye; lower jaw pointed, its tip reaching a little past front of eye; maxillary reaching base of lower jaw, about to edge of preopercle, pointed behind; gill-rakers as long as orbit. Pectorals scarcely reaching to ventrals, which reach half way from their base to vent; origin of dorsal midway between base of caudal and middle of eye.

Color silvery, slightly darker above, fins colorless.

This species resembles *Anchovia macrolepidota* of the Pacific. It differs in the more slender body; the curve of ventral outline is not so great, maxillary shorter; median scales in front of dorsal not forming scutes; head shorter; no dark longitudinal stripe. This species is between *Stolephorus* and *Anchovia*, and it makes the dis-

[redacted]

PŒCILIIDÆ.

30. Gambusia punctulata Poey.

Gambusia punctulata Poey, Memorias, I, 386, 1855 (Cuba); Jordan & Evermann, Fishes of North America, 680.

The anal fin has 9 rays, 10 or 11 counting rudiments, the oblique bar under the eye is indistinct in some specimens and wanting in others.

ESOCIDÆ.

31. Tylosurus raphidoma (Ranzani). Guard Fish.

Belone raphidoma Ranzani, Nov. Comm. Ac. Nat. Sci. Inst. Bonon., V, 1842, 359, pl. 37, fig. 1 (Brazil).
Tylosurus raphidoma, Jordan & Evermann, Fishes of North America, 716.

HEMIRAMPHIDÆ.

32. Hyporhamphus unifasciatus (Ranzani). Balahoo Piper; Half Beak.

Hemirhamphus unifasciatus Ranzani, Nov. Comm. Ac. Sci. Bonon., V, 1842, 326 (Brazil).
Hyporhamphus unifasciatus, Jordan & Evermann, Fishes of North America, 720.

Tip of lower jaw scarlet.

33. Hemiramphus brasiliensis (Linnæus).

Esox brasiliensis Linnæus, Syst. Nat., Ed. X, 314, 1758 (Jamaica).
Hemiramphus brasiliensis, Jordan & Evermann, Fishes of North America, 723.

AULOSTOMIDÆ.

34. Aulostomus maculatus Valenciennes.

Aulostomus maculatus Valenciennes, in Cuvier, Illustr. Poissons, pl. 92, fig. 2, about 1845; Jordan & Evermann, Fishes of North America, 754.

SYNGNATHIDÆ.

35. Siphostoma rousseau (Kaup).

Syngnathus rousseau Kaup, Lophobranchs, 40, 1856 (Martinique).
Siphostoma rousseau, Jordan & Evermann, Fishes of North America, 767.

36. Siphostoma robertsi Jordan & Rutter, new species.

Head 7½ in length; depth 2⅞ in head; eye 5⅜ in head; dorsal 20, on 0 + 4 rings; segments 17 + 32. Snout 2⅛ in head, with a slight keel; a slight keel on top of head, another above opercle, and one on anterior side of opercle, but not reaching posterior edge; shields without spines; lateral keel ending on last body segment; ventral keel on next to last; upper body keel extending nearly to end of dorsal fin, upper caudal beginning below it on first caudal segment; all ridges of body very prominent, the tail with four plane ridges; caudal pouch 3 in total length. Color mottled-brown, paler below,

the membrane connecting the segments pale bluish, forming cross stripes which are especially marked on the egg pouch; prominent pale cross bars on lower side of head; dorsal colorless, except that the base is finely dusted with brown; caudal thickly dusted with brown, except near base.

This species is most closely related to *Siphostoma jonesi*, differing in having a shorter dorsal with more rays, and in the lateral keel ending distinct from lower caudal keel.

One specimen, 4½ long. No. 4,988, L. S. Jr. Univ. Mus.

37. Hippocampus punctulatus Guichenot. Sea Horse.

Hippocampus punctulatus Guichenot in Sagra, Cuba Poiss., 174, pl. 5, fig. 2, 1850 (Cuba); Jordan & Evermann, Fishes of North America, 778.

ATHERINIDÆ.

38. Atherina laticeps Poey.

Atherina laticeps Poey, Memorias, II, 265, 1861 (Havana).
Atherina laticeps, Jordan & Evermann, Fishes of North America, 790.

MUGILIDÆ.

39. Mugil curema Cuvier & Valenciennes. Red and Black Eye Mullet.

Mugil curema Cuvier & Valenciennes, Hist. Nat. Poiss., XI, 87, 1836 (Brazil; Martinique; Cuba); Jordan & Evermann, Fishes of North America, 813.

Very dark above, becoming silvery below; lines along rows of scales show in reflected light; dorsal and caudal very heavily punc- [redacted]

HOLOCENTRIDÆ.

44. Holocentrus ascensionis (Osbeck). Welshman.

Perca ascensionis Osbeck, Iter Chin., 388, 1771, Ascension Island.
Holocentrus ascensionis, Jordan & Evermann, Fishes of North America, 848.

45. Holocentrus marianus Cuvier & Valenciennes.

Holocentrum marianum Cuvier & Valenciennes, III, 219, 1829 (Martinique)
Holocentrus marianus, Jordan & Evermann, Fishes of North America, 852.

A single specimen 6 in. long. Head 2⅗, depth 3 in length; eye 2½ in head; D. XI, 13; A. IV, 9; scales 4–45–7. Dorsal outline much more curved than ventral; mouth low, but little oblique, the lower jaw projecting and entering upper profile; maxillary to below middle of eye; eye large, lower margin of orbit cut by a line connecting tip of snout and upper base of pectoral; angle of opercle high, higher than top of pupil, with three sharp teeth, small teeth along the margin next the subopercle; subopercle long and narrow, dentate near upper end; preopercle very finely serrate, with a strong spine at angle; a single row of scales on opercle along margin of preopercle; suborbital bones very narrow, finely serrate; premaxillary groove on top of head as long as eye; length of pectoral equals head behind middle of eye; spinous dorsal depressible into a groove, highest (anterior) rays of soft dorsal equal to ventrals, longer than soft rays of anal; third anal spine very long and heavy, as long as pectorals; caudal forked almost to base, the lobes equal, as long as pectorals. Each row of scales with a red band, yellow lines between the rows; fins all yellowish.

This is a strongly marked species, very different from *Holocentrus ascensionis*, perhaps the type of a distinct genus, characterized by the large mouth and projecting chin.

MULLIDÆ.

46. Upeneus maculatus (Bloch).

Mullus maculatus Bloch, Ichthyologia, pl. 348, fig. 1, 1793 (Brazil).
Upeneus maculatus, Jordan & Evermann, Fishes of North America, 858.

47. Upeneus martinicus Cuvier & Valenciennes. King Mullet.

Upeneus martinicus Cuvier & Valenciennes, Hist. Nat. Poiss., III, 483, 1829 (Martinique); Jordan & Evermann, Fishes of North America, 859.

SCOMBRIDÆ.

48. Scomberomorus maculatus (Mitchill). Spanish Mackerel.

Scomber maculatus Mitchill, Trans. Lit. & Phil. Soc. N. Y., I, 1815, 426 (New York).
Scomberomorus maculatus, Jordan & Evermann, Fishes of North America, 874.

49. Scomberomorus regalis (Bloch).

Scomber regalis Bloch, Ichythologia, pl. 333, 1795 (Martinique).
Scomberomorus regalis, Jordan & Evermann, Fishes of North America, 875.

50. Scomberomorus cavalla (Cuvier). King Fish.

Cymbium cavalla Cuvier, Règne Animal, Ed. 2, II, 1829 (Brazil).
Scomberomorus cavalla, Jordan & Evermann, Fishes of North America, 875.

TRICHIURIDÆ.

51. Trichirus lepturus Linnæus. Cutlass Fish.

Trichiurus lepturus Linnæus, Syst. Nat., Ed, X, 246, 1758 (America); Jordan & Evermann, Fishes of North America, 889.

CARANGIDÆ.

52. Oligoplites saurus (Bloch & Schneider). Leather Coat.

Scomber saurus Bloch & Schneider, Syst. Ich., 321, 1801 (Jamaica).
Oligoplites saurus, Jordan & Evermann, Fishes of North America, 898.

53. Decapterus sanctæ-helenæ (Cuvier & Valenciennes).

Caranx sanctæ-helenæ Cuvier & Valenciennes, IX, 37, 1833 (St. Helena).
Decapterus sanctæ-helenæ, Jordan & Evermann, Fishes of North America, 908.

54. Trachurops crumenophthalmus (Bloch). Goggle Eye Jack.

Scomber crumenophthalmus Bloch., Ichth., pl. 343, 1793 (Acará, Guinea).
Trachurops crumenophthalmus, Jordan & Evermann, Fishes of North America, 911.

55. Caranx ruber (Bloch). Green Jack.

Scomber ruber Bloch, Ichthyologia, pl. 342, 1793 (St. Croix).
Caranx ruber, Jordan & Evermann, Fishes of North America, 919.

58. Caranx latus Agassiz. Horse Eye Jack.

Caranx latus Agassiz, Pisc. Bras., 105, 1829 (Brazil); Jordan & Evermann, Fishes of North America, 923.

In a specimen 20 in. long the opercular spot is nearly obsolete, and the adipose eyelid is highly developed on hinder side of eye.

59. Alectis ciliaris (Bloch).

Zeus ciliaris Bloch, Ichthyol., VI, 27, pl. 191, 1788 (East Indies).
Alectis ciliaris, Jordan & Evermann, Fishes of North America, 931.

60. Vomer spixi (Swainson).

Platysomus spixii Swainson, Class'n Fishes, 250, 406, 1839 (Brazil, after Agassiz and Spix). *Vomer gabonensis* Guichenot, Ann. Soc. Maine et Loire, 1865, 42 (Gaboon).

Head $2\frac{7}{8}$; depth $1\frac{3}{5}$; dorsal VI–I, 22; anal I, 18; eye $3\frac{3}{8}$ in head; maxillary $2\frac{1}{3}$; snout $1\frac{1}{3}$; caudal 1.

Body very deep, in form much like *Selene œrstedi*, profile very steep almost vertical, snout slightly protruding, mouth oblique, maxillary reaching to the vertical from front of eye, gill rakers 7+27, the longest little more than half eye.

Lateral line strongly arched in front, the arch $1\frac{1}{4}$ the straight part; plates of lateral line little differentiated; pectoral falcate, as long or slightly longer than head; ventrals small, under base of pectorals.

Color bluish above, sides silvery, fins except ventrals and anal dusky. Here described from specimens from Jamaica about 10 inches in length.

These specimens are evidently different from the northern *Vomer setipinnis* (= *Vomer browni*), the body in specimens of the same length being much deeper. It corresponds to the figure given by Agassiz of *Vomer browni*, this figure being the basis of *spixii* of Swainson. Probably all West Indian records of *Vomer setipinnis* belong to *Vomer spixi*.

61. Selene vomer (Linnæus).

Zeus vomer Linnæus, Syst. Nat., X, 266, 1753 (America).
Selene vomer, Jordan & Evermann, Fishes of North America, 939.

62. Chloroscombrus ectenurus Jordan & Osgood, Ms. New species.

Chloroscombrus chrysurus of authors, not of Linnæus.
Micropteryx cosmopolita Agassiz, not *Seriola cosmopolita* Cuvier, who bases the name on *Scomber chloris* Bloch, an African species from Acará, Guinea, Coll. Dr. Isert.

Two specimens $13\frac{1}{2}$ in. long.

Types No. 4,863, L. S. Jr. U. Museum, two specimens $13\frac{1}{2}$ inches long. Jamaica, J. S. Roberts.

Head $3\frac{7}{8}$; depth $2\frac{3}{5}$; D. VIII–I, 27; A. II–I–26. Snout slightly shorter than eye, which is $3\frac{1}{2}$ in head. Chord of curved part of lateral line $1\frac{3}{5}$ in straight part. Depth of caudal peduncle 2 in its length, measuring from the base of the last dorsal ray to the base of the first caudal ray. Pectorals long and falcate, 3 in length. Ventrals short, $2\frac{1}{5}$ in head, extending beyond the vent which is situated in a groove in which these fins fit. Depth of head equal to or slightly less than its length. The maxillary reaches the anterior edge of the eye, and is contained $2\frac{3}{5}$ times in the head.

Lateral line unarmed. Curve of ventral outline very slightly more pronounced than that of the dorsal. Dorsal and anal fin sheaths well developed. Tips of upper spines and rays dusky. A black blotch at base of upper rays of caudal, and a black axillary and opercular spot.

This is the common West Indian species of *Chloroscombrus*. The types are two specimens about 10 inches in length, collected at Jamaica by J. S. Roberts. Co-types are five specimens (L. S. Jr. Museum No. 406) collected by Dr. Jordan at Havana, Cuba.

The species is closely related to *Chloroscombrus chrysurus*, the common species of the South Atlantic and Gulf States, which it evidently represents in the West Indies. The species *chrysurus*, is deeper in every way, having a deeper body, a deeper head, and a deeper caudal peduncle. In *chrysurus*, also the eye is larger, the mouth more nearly vertical, and the arch of the lateral line higher.

63. Trachinotus glaucus (Bloch).

Chætodon glaucus Bloch, Ichthyologia, pl. 210, 1787 (Martinique).
Trachinotus glaucus, Jordan & Evermann, Fishes of North America, 940.

64. Trachinotus rhomboides (Bloch).

Chætodon rhomboides Bloch, pl. 209, 1787 (Martinique).

This West Indian species is apparently different from the northern *Trachinotus falcatus* with which it has been confounded. In specimens of the same size the vertical fins are much higher in the West Indian species.

Head 3¼; depth 1⅗ in length; eye 3⅓ in head; dorsal VI–I, 20; anal II-I, 18.

Back much elevated, but not angulated at origin of soft dorsal; end of snout not vertical, curved; head slightly concave at occiput. Maxillary to below anterior margin of pupil; eye on level of lower edge of premaxillary and axil of pectoral. Origin of soft dorsal behind tip of pectoral, its lobe much elongated, extending to middle of caudal; lobe of anal reaching to below base of caudal; caudal lobes equal, 2⅓ in body; pectoral rounded, 1⅓ in head; ventrals 2⅗ in head. Scales minute, large posteriorly near lateral line. Pale olive above, becoming silvery on belly, lobes of vertical fins dusky.

65. Trachinotus carolinus (Linnæus). Cobbler Fish.

Gasterosteus carolinus Linnæus, Syst. Nat., Ed. XII, 490, 1766 (Carolina).
Trachinotus carolinus, Jordan & Evermann, Fishes of North America, 944.

RACHYCENTRIDÆ.

66. Rachycentron canadum (Linnæus). Cobio.

Gasterosteus canadus Linnæus, Syst. Nat., Ed. XII, 491, 1866, Canada.
Rachycentron canadum, Jordan & Evermann, Fishes of North America, 948.

STROMATEIDÆ.

67. Rhombus paru (Linnæus). Puppy Fish.

Stromateus paru Linnæus, Syst. Nat., Ed. X, 248, 1758 (Jamaica, based on Sloane).
Rhombus paru, Jordan & Evermann, Fishes of North America, 965.

The specimens here noted have been compared with specimens found in the Washington market, with which they agree in all respects except in depth. The southern specimens have the depth of 1⅗, the northern 1⅘. If the two are really different, as is probable, the northern species will stand as *Rhombus alepidotus*.

CENTROPOMIDÆ.

68. Centropomus undecimalis (Bloch). Sea Snook.

Sciæna undecimalis Bloch, Ichthyol., VI, 60, pl. 303, 1792.
Centropomus undecimalis, Jordan & Evermann, Fishes of North America, 1,118.

SERRANIDÆ.

69. Petrometopon cruentatus (Lacépède). Rock Hind; Mabiner.

Sporus cruentatus Lacépède, Hist. Nat. Pois., IV, 157, pl. 4, fig. 1, 1803 (Martinique).

Petrometopon cruentatus, Jordan & Evermann, Fishes of North America, 1141.

Two specimens. One has dark brown reticulations on head enclosing hexagonal pale brown areas, and the spots on each side of the spinous dorsal are black, those on one side of the soft dorsal are silvery white, on the other black. In the other smaller specimen the reticulations of the head are pale bluish, and sharply define the hexagonal pale brown areas; reticulations are also more or less distinct on the soft rays of fins; the spots on each side of dorsal are all silvery white, except that two are partly black. Edges of all fins dark. The larger and darker specimen has a proportionately longer maxillary, the maxillary in two specimens being 1$\frac{5}{8}$ and 2 in head.

70. Bodianus fulvus (Linnæus). Lemon Yellow Butter Fish.

Labrus fulvus Linnæus, Syst. Nat., Ed. X, 287, 1758 (Bahamas).

Bodianus fulvus, Jordan & Evermann, Fishes of North America, 1,144.

Lemon yellow, becoming orange on upper part of side and base of dorsal, two round black spots on upper side of caudal, a few scattering small black spots on head and anterior side of body, none on end of lower jaw.

70a. Bodianus fulvus ruber (Bloch & Schneider). Rock Hind.

[redacted]

74. Epinephelus morio (Cuvier & Valenciennes).

Serranus morio Cuvier & Valenciennes, II, 285, 1828 (New York and San Domingo).
Epinephelus morio, Jordan & Evermann, Fishes of North America, 1,160.

75. Promicrops guttatus (Linnæus).

Perca guttata Linnæus, Syst. Nat., Ed. X, 292, 1758 (Brazil).
Promicrops guttatus, Jordan & Evermann, Fishes of North America, 1,162.

76. Mycteroperca venenosa apua (Bloch).

Bodianus apua Bloch, Ichth., VII, 37, pl. 229, 1790 (Brazil).
Mycteroperca venenosa apua, Jordan & Evermann, Fishes of North America, 1,173.

77. Mycteroperca bonaci (Poey). Marbled Rock Fish.

Serranus bonaci Poey, Memorias, II, 129, 1860 (Cuba).
Mycteroperca bonaci, Jordan & Evermann, Fishes of North America, 1,174.

Two specimens 10 in. long; color markings very much faded. Two or three rows of alternating bronze spots from below eye toward opercle; the reticulations on body nearly obliterated; pectorals slightly dusky, the other fins almost wholly black, a subterminal streak of light olive across caudal, and a similar one along dorsal and anal, vertical fins narrowly edged with pale.

78. Mycteroperca tigris (Cuvier & Valenciennes). Rock Fish.

Serranus tigris Cuvier & Valenciennes, IX, 440, 1833 (San Domingo).
Mycteroperca tigris, Jordan & Evermann, Fishes of North America, 1,187.

79. Mycteroperca hopkinsi Jordan & Rutter. New Species.

Allied to *Mycteroperca calliura*, differing in having fewer gill-rakers, more slender body, smaller scales, and a less lunate caudal.

Head $2\frac{2}{3}$; depth $4\frac{1}{2}$; D. XI, 15; A. III, 11; scales about 125; eye 6 in head, $1\frac{1}{2}$ in snout.

Body long, not much compressed; angle of preopercle sharply serrate; gill-rakers 6+9, counting rudiments; nostrils close together, the posterior larger, with a horizontal septum across base; profile concave above nostrils; maxillary nearly to posterior margin of eye, $2\frac{1}{4}$ in head; lower jaw projecting; two anterior canines of upper jaw very strong; third and fourth dorsal spines longest; posterior portion of anal truncate; caudal concave. Pectorals 2, ventrals $2\frac{1}{3}$, and caudal $1\frac{1}{2}$ in head. Color of alcoholic specimen nearly uniform brownish, side of jaws paler; soft dorsal, anal, ventrals and caudal, with a narrow pale edging, these fins otherwise brownish-olive, with a subterminal band of black; pectorals pale, darker in middle.

One specimen, about 6 inches long, numbered 5,073, L. S. Jr. Univ. Museum.

It is named for Mr. Timothy Hopkins.

80. Hypoplectrus unicolor (Walbaum).

Perca unicolor Walbaum, Artedi Piscium, III, 352, 1792 (locality unknown).
Hypoplectrus unicolor, Jordan & Evermann, Fishes of North America, 1,190 and 1,192.

80a. Hypoplectrus unicolor puella (Cuvier & Valenciennes).

Plectropoma puella Cuvier & Valenciennes, Hist. Nat. Poiss., II, 405, pl. 37, 1828 (Martinique).
Hypoplectrus unicolor puella, Jordan & Evermann, Fishes of North America, 1192.

80b. Hypoplectrus unicolor aberrans (Poey).

Hypoplectrus aberrans Poey, Synopsis, 291, 1868 (Havana).
Hypoplectrus unicolor aberrans, Jordan & Evermann, Fishes of North America, 1,193.

Soft dorsal finely specked with brown (in spirits); body cloudy yellowish brown; the scales behind and above pectoral each with a pearly dot; a large black spot on caudal peduncle; black spot in front of eye, surrounded by sky blue, a blue stripe across cheek and around eye, one or two vertical blue stripes behind eye, and several on top of head.

81. Dules dispilurus (Günther). Grassy Ground Rock Fish.

Centropristis dispilurus Günther, Proc. Zool. Soc. Lond., 1867, 99, (Trinidad).
Dules dispilurus, Jordan & Evermann, Fishes of North America, 1,219.

Several specimens 3¼ in. long, which according to Mr. Roberts is the maximum size. He also states that in life there are " two dorsal

83. Rypticus coriaceus (Cope). Black Soap Fish.

Eleutheractis coriaceus Cope, Trans. Am. Phil. Soc., 1870, 467 (St. Martins).
Rypticus coriaceus, Jordan & Evermann, Fishes of North America, 1,233.

Several specimens 5 to 6 in. long. One has three opercular spines. Aside from the number of opercular spines, this species may be distinguished from the preceding by its more slender body, depth 1⅗ to 1⅘ in head, and by the less projecting lower jaw.

PRIACANTHIDÆ.

84. Priacanthus arenatus Cuvier & Valenciennes.

Priacanthus arenatus Cuvier & Valenciennes, III, 97, 1829 (Brazil); Jordan & Evermann, Fishes of North America, 1,237. I, 1237

85. Priacanthus cruentatus (Lacépède).

Labrus cruentatus Lacépède. Hist, Nat. Poiss., III, 522, 1800 (Martinique).
Priacanthus cruentatus, Jordan & Evermann, Fishes of North America, I, 1,238.

LUTIANIDÆ.

86. Neomænis griseus (Linnæus).

Labrus griseus Linnæus, Syst. Nat., Ed. X, 1758, 283 (after Catesby).
Lutjanus griseus, Jordan & Fesler, Sparoid Fishes, 441.

Apparently none of the American *Lutianinæ*, unless it be *Lutianus viridis*, are congeneric with the East Indian type of *Lutianus*. The naked vertex with a band of scales at the temples is found in the American forms, while in *Lutianus* the top of the head is evenly scaled. There is also considerable difference in the skull in the species compared. For the American forms, typified by *Lutianus griseus*, the name *Neomænis* Girard may be revived.

87. Neomænis jocu (Bloch & Schneider).

Anthias jocu Bloch & Schneider, Syst. Ichth., 310, 1801 (Cuba, based on Parra).
Lutjanus jocu, Jordan & Fesler, Sparoid Fishes, 443.

88. Neomænis apoda (Walbaum). Mattin Snapper.

Sparis apoda Walbaum, Artedi Piscium, 111, 1792 (after Catesby).
Sparus caxis Bloch & Schneider, Ichthyology, 284, 1810 (Havana, after Parra).
Lutjanus caxis, Jordan & Fesler, Sparoid Fishes, 443.

Nearly uniform gray, more or less dark above, with faint yellow lines on side; body with about six pale cross streaks sometimes very distinct; one or two rows of small dots from below eye forward to edge of preorbital; pectorals pale yellow, ventrals white, caudal and spinous dorsal dusky, soft dorsal and anal pale. Faded specimens may be readily distinguished by the very distinct fleshy fold which fits closely against end of maxillary.

89. Neomænis buccanella (Cuvier & Valenciennes). Black Fin Snapper.

Mesoprion buccanella Cuvier & Valenciennes, II, 455, 1828 (Martinique).
Lutjanus buccanella, Jordan & Fesler, Sparoid Fishes, 445.

Nearly uniform crimson, caudal and lower fins tinged with yellow, axil of pectoral jet black.

90. Neomænis vivanus (Cuvier & Valenciennes).

Mesoprion vivanus Cuvier & Valenciennes, II, 454, 1828 (Martinique).
Lutjanus vivanus, Jordan & Fesler, Sparoid Fishes, 445.

91. Neomænis analis (Cuvier & Valenciennes).

Lutjanus analis Poey, Enumeratio, 29, 1875 (Cuba); Jordan & Fesler, Sparoid Fishes, 1893, 445.

Maxillary hardly reaching eye. Differs from *synagris* in the very weak vomerine teeth, pointed dorsal and anal, and elongate posterior nostril.

92. Neomænis synagris (Linnæus). Red Tail Snapper.

Sparus synagris Linnæus, Syst. Nat., X, 280, 1758 (after Catesby).
Lutjanus synagris, Jordan & Fesler, Sparoid Fishes, 450.

Seven yellow lines on body, caudal indistinctly edged with black; outer rays, red in one specimen, other fins pale; narrow lines, probably blue in life, extending forward from eye; jaws purplish. Lateral line 50.

93. Neomænis mahogoni (Cuvier & Valenciennes).

Mesoprion mahogoni Cuvier & Valenciennes, II, 447, 1828 (Martinique).
Lutjanus mahogoni, Jordan & Fesler, Sparoid Fishes, 451.

HÆMULIDÆ.

97. **Hæmulon macrostomum** Günther. Gray Grunt; Yellow Tail.

Hæmulon macrostoma Günther, Cat., I, 308, 1859 (Jamaica); Jordan & Fesler, Sparoid Fishes, 470.

Silvery gray, several dark lines on sides, those from point of opercle and along lateral line most distinct; back on each side of dorsal greenish-yellow, edge of dorsal and caudal tinged with the same color; pectoral pale orange; fins otherwise dusky, the ventrals nearly black.

98. **Hæmulon bonariense** Cuvier & Valenciennes. Black Grunt.

Hæmulon bonariense Cuvier & Valenciennes, Hist. Nat. Poiss., V, 254, 1830 (Buenos Ayres); Jordan & Fesler, Sparoid Fishes, 470.

The two fine specimens correspond to the account given by Jordan & Fesler. The dark stripes on the side are dark bronze-brown in life.

99. **Hæmulon parra** (Desmarest). Black Grunt.

Diabasis parra Desmarest, Prem. Décade Ichthyol., 30, tab., 2, f. 2, 1823 (Havana).
Hæmulon parra, Jordan & Fesler, Sparoid Fishes, 471.

100. **Hæmulon carbonarium** Poey. Cæsar Grunt.

Hæmulon carbonarium Poey, Memorias de Cuba, II, 176, 1860 (Cuba); Jordan & Fesler, Sparoid Fishes, 472.

Base of spinous dorsal yellow, fins otherwise very dusky.

101. **Hæmulon melanurum** (Linnæus). Cæsar Grunt.

Perca melanura Linnæus, Syst. Nat., X, 292, 1858 (based on Catesby's figure; Bahamas).
Hæmulon melanurum, Jordan & Fesler, Sparoid Fishes, 472.

102. **Hæmulon sciurus** (Shaw). Hump Back Grunt.

Sparus sciurus Shaw, General Zoology, IV, pl. 64, 1803 (based on figure and description of *Anthias formosus* Bloch, (Antilles).
Hæmulon sciurus, Jordan & Fesler, Sparoid Fishes, 474.

103. **Hæmulon plumieri** (Lacépède). Red Mouth Grunt.

Labrus plumieri Lacépède, Hist. Nat. Poiss., III, 480, 1802, pl. 2, f. 2 (on a copy of a drawing by Plumier, identified with this species by Cuvier).
Hæmulon plumieri, Jordan & Fesler, Sparoid Fishes, 475.

Stripes of head faintly indicated on anterior part of body.

104. **Hæmulon flavolineatum** (Desmarest). Deep Water Grunt.

Diabasis flavolineatus Desmarest, Prem. Décade Ichth., 1823, 35, pl. 2, f. 1 (Cuba).
Hæmulon flavolineatum, Jordan & Fesler, Sparoid Fishes, 476.

Color as described by Jordan & Fesler, except that the black lines are wanting (size of specimen 7 in.).

105. Hæmulon album Cuvier & Valenciennes. White Grunt.

Hæmulon album Cuv. & Val., V, 241, 1830 (St. Thomas); Jordan & Fesler, Sparoid Fishes, 469.

106. Bathystoma aurolineatum Cuvier & Valenciennes. Cæsar Grunt.

Hæmulon aurolineatum Cuvier & Valenciennes, V, 237, 1830 (Brazil, San Domingo); Jordan & Fesler, Sparoid Fishes, 486.

A yellow stripe about as wide as a scale from eye to below posterior end of dorsal, another of equal length and width from top of head along side of back; nearly every row of scales with a faint narrow yellow line; end of snout bluish; a dark blotch at base of caudal.

107. Brachygenys chrysargyreus (Günther).

Hæmulon chrysargyreum Günther, Cat., I, 314, 1859 (Trinidad); Jordan & Fesler, Sparoid Fishes, 476.

Several specimens very pale in color.

108. Anisotremus surinamensis (Bloch).

Lutjanus surinamensis Bloch, Ichth., pl. 253, 1791 (Surinam).
Anisotremus surinamensis, Jordan & Fesler, Sparoid Fishes, 484.

109. Anisotremus virginicus (Linnæus). Pork Bream.

Sparus virginicus Linnæus, Syst. Nat., X, 281, 1858.
Anisotremus virginicus, Jordan & Fesler, Sparoid Fishes, 486.

Body with alternating blue and golden stripes, which are from one to two times as wide as scale, a golden stripe on base of anal; webs of dorsal and anal golden; a broad black band from nape through

[redacted]

(2nd) equal to or slightly less than longest spine. Pectoral pointed, $1\frac{1}{4}$ to $1\frac{3}{5}$ in head. Ventral broad, the margin nearly straight, inner ray $1\frac{1}{4}$ in 2nd which is 2 in head; first ray branched once, slightly filamentous, other rays much branched. Second and third anal spines about equal, 3 to $3\frac{3}{4}$ in head, relatively larger in smaller specimens, the second stouter; first soft ray $2\frac{1}{2}$ in head; margin of anal slightly concave, the last ray shorter than second spine. Upper lobe of caudal longer, more noticeable in the smaller specimens, $1\frac{1}{3}$ to $1\frac{1}{2}$ in head, middle rays $1\frac{3}{5}$ in upper. Pectoral scaly at base only, other fins, except spinous dorsal, more or less completely scaled, a narrow sheath of scales on sides of dorsal and anal, supplementary scales slightly developed in axil of ventrals. Least depth of caudal peduncle $1\frac{1}{2}$ to $1\frac{3}{5}$ in the length from below end of dorsal, its length being equal to middle caudal rays. Lateral line and rows of scales above it parallel with back, scales below lateral line in horizontal rows. Color in alcohol: Dark olive above, lower sides more or less silvery, the larger specimens much the lighter; a dark line along each row of scales below lateral line, these rather indistinct in larger specimens; scales above lateral line with dark centers, these not forming distinct lines; a diffuse dark blotch on scapular region, very faint in the larger specimens; pectorals colorless, other fins punctate, the margins very dark. A more or less distinct pale streak curving backward and upward from corners of mouth to behind eye. There is considerable variation in the ground color, the larger specimen being distinctly silvery, some of the smaller heavily washed with olive and having the scapular blotch more developed.

Our specimens differ from Steindachner's description in having a shorter maxillary, not reaching eye, narrower preorbital and a blotch on scapular region.

Five specimens $5\frac{1}{2}$ to $7\frac{1}{2}$ inches long. This species has not before been noticed in the West Indies.

SPARIDÆ.

112. Calamus calamus (Cuvier & Valenciennes). White Porgee.

Pagellus calamus Cuvier & Valenciennes, VI, 206, pl. 152, 1836 (Martinique. San Domingo).
Calamus calamus, Jordan & Fesler, Sparoid Fishes, 511.

113. Calamus penna (Cuvier & Valenciennes). White Porgee.

Pagellus penna Cuv. & Val., VI, 209, 1830 (Brazil).
Calamus penna, Jordan & Fesler, Sparoid Fishes, 514.

114. Calamus proridens Jordan & Gilbert. Sheeps Head Porgee.

Calamus proridens Jordan & Gilbert, Proc. U. S. Nat. Mus., 1884, 150 (Key West).

115. Calamus bajonado (Poey). White Porgee.

Calamus bajonado Bloch & Schneider, Syst. Ichth., 284, 1801 (Havana, after Parra).

116. Archosargus unimaculatus (Bloch). Shore Bream.

Perca unimaculata Bloch, pl. 308, 1798 (Brazil).
Archosargus unimaculatus, Jordan & Fesler, Sparoid Fishes, 520.

Accessory scale of ventrals very long, almost as long as ventral spine.

LOBOTIDÆ.

117. Lobotes surinamensis (Bloch). Whiting; Sea Sand Fish.

Holocentrus surinamensis Bloch, Ichthyol., pl. 243, 1797 (Surinam).
Lobotes surinamensis, Jordan & Gilbert, Synopsis, 535.

Head $2\frac{3}{5}$, depth $1\frac{4}{5}$ in length; eye $5\frac{1}{3}$ to 6 in head; D. XII, 15; A. III, 11; B. VI; scales 10–45–~~16~~. See specimen in coll. '20'

Body deep, compressed, head heavy, anterior profile concave, but convex from front of dorsal to occiput. Mouth small, maxillary $2\frac{2}{5}$ in head, slipping slightly under preorbital for its full length; jaws each with a band of villiform teeth, in front of which is a row of larger conical teeth; no other teeth in the mouth. Eye nearly two in interorbital space in a specimen 8 in. long, $1\frac{1}{2}$ in smaller specimens; interorbital space nearly flat, slightly raised in the middle and at the edges; scales on top of head extending forward past middle of eye, the anterior boundary of the scales with three nearly equal emarginations, one behind premaxillary groove and one behind each [redacted]

pale olive, in one specimen the latter predominating; a distinct dark brown or black stripe from eye toward origin of dorsal, another from eye to angle of preopercle, a pair of black stripes on top of head, a pair of small black blotches behind nape and a faint black blotch in front of dorsal; pectoral colorless, other fins black, anterior edge of soft dorsal and broad tip of caudal white.

So far as is known, this species is confined to the western Atlantic. It is certainly different from *Lobotes erate* of the East Indies, and the Pacific coast species of *Lobotes*, called *Lobotes pacificus* by Dr. Gilbert (Ms.), is widely different and may belong to a different genus.

GERRIDÆ.

118. **Ulæma lefroyi** (Goode).

Diapterus lefroyi Goode, Amer. Jour. Sci. and Arts, 1874, 123, (Bermudas).
Gerres lefroyi, Evermann & Meek, Proc. Acad. Nat. Sci. Phila., 1886, 259.

119. **Xystæma cinereum** (Walbaum). Deep Water Shad.

Mugil cinereus Walbaum, Artedi Piscium, 228, 1792 (Florida Keys; Bahamas; after Catesby).
Gerres cinereus, Evermann & Meek, Proc. Acad. Nat. Sci. Phila., 1886, 263.

Crossbars on body scarcely indicated; otherwise as described by Evermann & Meek.

120. **Eucinostomus pseudogula** (Poey). Long Shad.

Eucinostomus pseudogula Poey, Enum. Pisc. Cub., 53, pt. I, 1875 (Havana).
Gerres pseudogula, Evermann & Meek, Proc. Acad. Nat. Sci. Phila., 1886, 260.

Seemingly very abundant.

121. **Eucinostomus gula** (Cuvier & Valenciennes).

Gerres gula Cuvier & Valenciennes, VI, 464, 1830 (Martinique); Evermann & Meek, Proc. Acad. Nat. Sci. Phila., 1886, 264.

The numerous specimens here noted are, on an average, more slender than specimens from Florida with which we have compared them. They are, however, quite variable, and there is no basis for a specific distinction. Depth 2⅗ to 2¾.

122. **Gerres rhombeus** Cuvier & Valenciennes. Schrer Fish; Maccaback Schrer Fish.

Gerres rhombeus Cuvier & Valenciennes, VI, 459, 1830 (Martinique; San Domingo); Evermann & Meek, Proc. Acad. Nat. Sci. Phila., 1886, 266.

123. **Gerres olisthostomus** Goode & Bean.

Gerres olisthostoma Goode & Bean, Proc. U. S. Nat. Mus., 1882, 423 (Indian River, Florida); Evermann & Meek, Proc. U. S. Nat. Mus., 1886, 267.

124. Gerres brasilianus Cuvier & Valenciennes. Stone Bar.

Gerres brasilianus Cuvier & Valenciennes, VI, 458, 1830 (Brazil; Porto Rico); Evermann & Meek, Proc. Acad. Nat Sci. Phila., 1886, 268.

Four fine specimens, 9 to 10 in. long. Silvery-gray, finely dusted with black anteriorly; dark lines following the rows of scales; dorsal dusky, almost black in one specimen; caudal dusky, anals and ventrals scarcely dusky; ventrals slightly tinged with yellow; pectorals colorless, one axil dusky; no supraocular spot.

SCIÆNIDÆ.

125. Cynoscion jamaicensis (Vaillant & Bocourt). Mongalar Drummer.

Otolithus jamaicensis Vaillant & Boucourt, Miss. Sci. au Mexique, Poissons, 1874, 156 (Jamaica).

Head 3; depth $3\frac{1}{2}$ ($4\frac{2}{5}$ with caudal); eye $4\frac{1}{2}$ in head; dorsal X-I, 25 to 27; anal I, 9; scales 63.

Snout $3\frac{3}{4}$ in head, longer than eye; maxillary to below middle of pupil, $2\frac{1}{4}$ in head, lower jaw projecting. Depth of head over hinder margin of eye $1\frac{3}{4}$ in its length. A single large canine in front of upper jaw, four or five small teeth on side of lower jaw, other teeth few and small. Tongue free at end and sides, with a broad median groove. Slit of posterior nostril nearly vertical. Gill-rakers 3+7 =10, the longest $\frac{1}{2}$ eye. Opercular flap extending beyond upper base of pectoral. Preopercle with a membranous margin. Dorsals [redacted]

126. Odontoscion dentex (Cuvier & Valenciennes).

Corvina dentex Cuvier & Valenciennes, V, 139, 1830 (San Domingo).
Odontoscion dentex, Jordan & Eigenmann, Sciænidæ, 377.

127. Bairdiella ronchus (Cuvier & Valenciennes). Ground Drummer.

Corvina ronchus Cuvier & Valenciennes, V, 107, 1839 (Maracaibo; Surinam).
Bairdiella ronchus, Jordan & Eigenmann, Sciænidæ, 389, 1889.

The two specimens here noted, which are 9 in. long, differ slightly from a small one from Bahia. The second anal spine is $1\frac{3}{4}$ in head and does not quite reach the tips of the first two soft rays. The anal basis is more nearly horizontal, the anterior profile is slightly concave, the eye is shorter than snout, the teeth are smaller. The depth is a little less than head. Soft dorsal and anal scarcely dotted with darker ; brownish dots on sides as in *B. armata.*

128. Micropogon furnieri (Desmarest). White Mouth Drummer.

Umbrina furnieri Desmarest, Première Décade Ichthyol., 22, pt. II, fig. 3, 1823 (Cuba).
Micropogon furnieri, Jordan & Eigenmann, Sciænidæ, 76.

A specimen $10\frac{1}{2}$ in. long has the following measurements: Head $3\frac{1}{8}$; depth $3\frac{2}{5}$; D. X-I, 28 ; A. II, 8. The color is less silvery than that of specimens from Havana, but otherwise it is essentially the same.

129. Umbrina coroides Cuvier & Valenciennes.

Umbrina coroides Cuvier & Valenciennes, Hist. Nat. Poiss., V, 187, 1830 (Brazil).

Head $3\frac{1}{2}$; depth $3\frac{1}{2}$ in length ; eye $4\frac{3}{5}$ in head ; scales 6–50–9 ; dorsal X-I, 27 ; anal II, 6.

Highest point of dorsal outline at anterior third of spinous dorsal, the anterior outline more strongly curved. Mouth inferior, horizontal or nearly so, teeth equal, in bands ; barbel short, blunt ; width of preorbital equal to length of eye ; nostrils close together, the posterior oblong, more than twice as large as anterior, situated immediately in front of eye ; preopercle finely and evenly serrate above angle ; opercle with two dull points, not extending to edge of marginal membrane, the lower somewhat more acute, both evenly projecting. The lobes and pores in front of the mouth well-developed. Pectorals as long as ventrals, $1\frac{3}{4}$ in head, inserted under opercular membrane ; ventrals inserted behind pectorals, the outer ray with a very fine filament. Third dorsal spine longest, $2\frac{1}{5}$ in head. Caudal slightly emarginate, the lower angle slightly rounded, upper and longest rays $1\frac{3}{8}$ in head, or equal to head in front of oper-

cle. Ground color steel-gray, somewhat silvery (slightly golden in one specimen), 9 dusky bars on side, the anterior and posterior less distinct, two in front of dorsal two under spinous dorsal, the fifth in front of second dorsal, the last at end of dorsal; each row of scales above belly with a dark line, these oblique above lateral line, irregular below; tip of spinous dorsal black, edge of soft dorsal dusky, ventral and tip of caudal faintly dusky, underside of opercle black.

This description is based on three perfect specimens 10 in. long. They are not so deep as the figure given by Cuvier (117), the caudal is shorter, and there are two fewer rays in the dorsal.

It seems best not to use the name *Umbrina broussonetii* for this species, as the short account given by Cuvier and Valenciennes does not agree with the species, and Broussonet's specimens may not have come from Jamaica.

130. Menticirrhus martinicensis (Cuvier & Valenciennes). Jews Harp Drummer.

Umbrina martinicensis Cuvier & Valenciennes, V, 186, 1830 (Martinique).
Menticirrhus martinicensis, Jordan & Eigenmann, Sciænidæ, 429, 1889.

Indistinct blotches on back and sides, scales above closely and finely punctate, below with larger punctulation on a silvery ground. All fins dusky at tip, pectoral and anterior dorsal very dark. D. X-I, 24.

131. Eques acuminatus (Bloch & Schneider).

Grammistes acuminatus Bloch & Schneider, Syst. Ichth., 184, 1801.
Eques acuminatus, Jordan & Eigenmann, Sciænidæ, 98.

[redacted]

spinous dorsal nearly horizontal behind third spine, the last and highest spine being $1\frac{3}{4}$ in head; soft dorsal somewhat higher, pointed, the eighth and highest ray $1\frac{1}{6}$ in head; anal similar to soft dorsal, its highest ray $1\frac{2}{5}$ in head; tip of soft dorsal extending beyond that of anal, almost to middle length of caudal; caudal forked, the lobes rounded, the upper a little longer than head, $\frac{1}{6}$ longer than lower, middle rays of fin $1\frac{2}{3}$ in longest; length of pectoral equal to that of lower caudal lobe, a little greater than that of highest dorsal rays, about $1\frac{1}{10}$ in head; ventrals slightly filamentous, extending beyond origin of anal, slightly longer than the upper caudal lobe; least depth of caudal peduncle greater than its length, $2\frac{1}{6}$ in head; a row of scales on the membrane of every ray in the vertical fins, those on spinous dorsal larger and extending nearly to margin, those on soft portions of vertical fins smaller (the rays being close together) and extending about half way to margins; axillary scale of ventral not much developed. Nearly uniform dusky, the tips of the scales lighter, thus forming more or less distinct vertical streaks of light and dark; fins uniformly black; a dark spot at upper base of pectoral and another at lower; opercle darker than surrounding parts; a few very faint light points below eye.

The specimens here described have been compared with specimens of *Eupomacentrus fuscus* of similar size, from Albrolhos Islands, Brazil, with which species they are most closely related. Our specimens have the caudal more deeply forked, the dorsal and anal higher, the vertical fins less densely scaled, the axillary scale shorter, much longer ventrals, the caudal and pectorals not lighter than other fins; *and two dark-brown spots at base of pectoral, and the axil entirely black.*

This description is based on two specimens 4 in. long. 4,969, L. S., Jr. Univ. Mus.

134. Chromis multilineatus Guichenot.

Heliases multilineatus Guichenot, Sagra, Poiss. Cuba, 76, 1855, Havana, in part.

Furcaria puncta Poey, Mem., II, 195, 1860.

Head $3\frac{3}{5}$; depth $2\frac{3}{4}$ in length; eye $3\frac{1}{4}$ in head; dorsal XII, 11; anal II, 12; scales 4–28–9; branchiostegals 5 or 6.

Body elongate, both curvatures about equal, head slightly concave in front of eye: eye low, a line from tip of snout to tip of opercle passing through lower edge of pupil; maxillary slipping under preorbital, its tip below anterior margin of orbit; a band of villiform teeth in each jaw, in front of which is a single row of conical pointed teeth, the most anterior larger, especially in lower jaw; no

regular serræ on any of the opercular bones, but the preopercle slightly rough at angle and above, opercle with a single obtuse point; snout equal to eye; lateral line ceasing on front of end of dorsal, with 19 scales; a series of disconnected pores along the side of tail; fourth dorsal spine highest $2\frac{1}{3}$ in head; soft dorsal pointed, the tips reaching base of caudal, longest ray $1\frac{3}{5}$ in head; second anal spine 2 in head, equal to soft rays; pectoral equal to head; ventral slightly filamentous, reaching past vent, $1\frac{1}{3}$ in head; axillary scale and scale between the fins, long, attenuate; caudal deeply forked, the lobes pointed, the upper longer.

Color, in alcohol: back dusky, becoming paler with bluish on the sides, with faint lines along side of belly, white below; dorsal black, the last 4 or 5 rays white; middle rays of caudal white, outer rays dusky, tip of soft dorsal yellowish; anal slightly dusky; pectoral colorless, the axil black, the black showing as a small blotch at upper base; ventrals white; a sulphur-yellow blotch across tail behind dorsal.

Two specimens, $4\frac{1}{2}$ in. long. No. 4,963, L. S. Jr. Univ. Mus.

The specimens here described differ from the description of *punctus* Poey, in having but 6 branchiostegals, and in having the yellow dorsal margin restricted to the soft portion. The species is very close to *Chromis marginatus*. Compared with a specimen of this species from Bahia, *Chromis multilineatus* differs in the following respects: body more elongate, a greater number of last rays of dorsal yellow,

[redacted]

137. Chlorichthys bifasciatus (Bloch).

Labrus bifasciatus Bloch, Ichthyol., pl. 283, 1792 (East Indies).
Thalassoma bifasciatum, Jordan, Labroid Fishes, 56.

Head and iris very dark purple; body to tip of pectorals black, posteriorly green, the base of the scales darker; caudal peduncle dusky, greenish on sides; a pale greenish band across back and sides through front of spinous dorsal; outer rays of caudal black, inner white; spinous dorsal black, soft dorsal greenish with a pale margin; anal greenish, dusky anteriorly; pectoral white, the tips and base black; outer rays of ventrals black, others pale; head without color markings, but the numerous pores on the cheek seem to have mucous tubes radiating from the eye.

SCARIDÆ.

138. Sparisoma flavescens (Bloch & Schneider).

Scarus flavescens Bloch & Schneider, Syst. Ichth., 290, 1801.
Sparisoma flavescens, Jordan, Labroid Fishes, 74.

Caudal fin distinctly barred with brown, except the middle rays which are pale. Body uniform brownish-olive; dorsal mottled with brown, anal and ventrals white; pectorals colorless, a black spot at upper base of pectorals; chin and throat white; cheeks and top of head washed with cherry red. (Color notes from alcoholic specimen). Caudal lunate, the upper lobe the longer.

One specimen, 10 in. long.

139. Sparisoma distinctum (Poey).

Scarus distinctus Poey, Mem., II, 423, 1860 (Cuba).

Sides olivaceous, mottled with darker, an indistinct dark band from above pectoral to caudal; vertical fins mottled with bright red, especially posteriorly, the caudal being entirely red in some specimens; a white cross blotch on tail behind dorsal; the scales below more or less distinctly pale edged; pectorals tinged with yellowish olive; ventrals white; some specimens with the belly and ventral fins almost entirely red, the outer rays only being white, others with but little red anywhere. This species is the *frondosum* of Günther and of Jordan but not of Agassiz, which is the *aracanga* of Günther,

140. Sparisoma rubripinne (Cuvier & Valenciennes).

Scarus rubripinnis Cuvier & Valenciennes, XIV, 199, 1839 (San Domingo).

A single specimen 9 in. long. The life colors of this specimen were not noted. In alcohol it is olive, mottled with lighter, nearly white below; a rather distinct white band below chin; dor-

sal mottled; caudal strongly marked with cross blotches, a pair of subterminal blotches of white which nearly meet in the middle; other fins all white, the pectoral dusky (not black) at base; no yellow blotch behind dorsal. Margin of caudal concave; forehead strongly convex. The names *rubripinnis*, *circumnotatus*, *emarginatus*, *virens* and *truncatus* seem to have been based on this species, which is distinct from *S. flavescens*, and probably from *S. distinctum* and *S. frondosum*.

141. Sparisoma brachiale (Poey).

Scarus brachialis Poey, Memorias, II, 345, 1860 (Cuba).
Sparisoma brachiale, Jordan, Labroid Fishes, 75.

142. Sparisoma chrysopterum (Bloch & Schneider). Blue Parrot.

Scarus chrysopterum Bloch & Schneider, Syst. Ich., 286, 1801, pl. 57 (American Seas).
Sparisoma chrysopterum, Jordan, Labroid Fishes, 76.

Deep blue-green, head and portion behind pectorals brighter; an ill-defined pale band on lower part of sides; lower part of body greenish. Dorsal and anal yellowish; caudal with upper and lower rays green, tip with a narrow green border, in front of which is a narrow orange crescent, the remaining portion of the central rays pale yellow. Pectoral colorless, the upper rays tinged with lemon-yellow, a dark spot at upper edge of base, axil orange, some orange in front of base; teeth bluish.

143. Sparisoma lorito Jordan & Swain.

[redacted]

blue except for gray edging; head below livid olive. Dorsal light yellowish, tips of spines and rays normally blue, base of soft part blue; anal bluish-gray, with deep blue band at base and edge; pectoral blue-gray, edged with bright blue above, tips broadly orange; caudal blue-green, with a lunate yellow band, behind this a deep blue-band, tips of rays pale, outer rays deep blue, a faint band of golden-gray at base; ventrals yellowish, blue anteriorly.

145. Sparisoma aurofrenatum (Cuvier & Valenciennes).

Scarus aurofrenatus Cuvier & Valenciennes, XIV, 191, 1839 (San Domingo).
Sparisoma aurofrenatum, Jordan, Labroid Fishes, 77.

Sides rosy, dusky olive on back and top of head; iris red; a white streak backward from corner of mouth past eye, bordered on each side by dusky; a yellow and black blotch below lateral line on third or fourth scale behind head; dorsal yellowish, becoming reddish-orange posteriorly; anal crimson, narrowly edged with black; caudal pale yellowish at base, outer rays and lunate stripes across middle light red, the middle rays bluish beyond, with a faint reddish edge, tips of outer rays black.

146. Sparisoma abildgaardi (Bloch). Rose Back Parrot.

Scarus abildgaardi Bloch, pl. 259, 1791.
Sparisoma abildgaardi, Jordan, Labroid Fishes, 78.

Back and sides mottled olive, the scales with dark edges; top of head dark olive; belly abruptly cherry-red or scarlet; lower part of head black, dashed with red, a pale band at base of lower jaw. Lower fins scarlet, pectoral paler, caudal yellowish washed with red; dorsal dusky olive, tinged with red behind; dorsal all red in one specimen; margin of opercle blue-black; teeth pale.

147. Sparisoma radians (Cuvier & Valenciennes).

Scarus radians Cuvier & Valenciennes, XIV, 206, 1839.
Sparisoma radians, Jordan, Labroid Fishes, 79.

148. Scarus punctulatus Cuvier & Valenciennes.

Scarus punctulatus Cuvier & Valenciennes, XIV, 195, 1839 (Martinique); Jordan, Labroid Fishes, 84.

Back plain dusky yellow anteriorly; scales on sides and back posteriorly green, broadly tipped with yellow; sides of head pinkish, a green stripe connecting upper side of orbits and extending backward to gill-openings; lips green, the lower with an oblong pinkish spot on each side, these connected or not; the green band of lower lip extending backward under eye to gill-opening; breast plain bluish; dorsal dull orange, its margin and base green, and

S-shaped markings on the rays; anal similar to dorsal, but the markings on the rays nearly round; caudal marked with rivulations of green and orange, the outer rays deep green; pectoral green at base, upper margins yellowish, otherwise colorless; outer rays of ventrals green, otherwise colorless.

149. Scarus croicensis Bloch.

Scarus croicensis Bloch, Ichthyologia, pl. 221, 1790 (St. Croix); Jordan, Labroid Fishes, 87.

Color quite variable, usually pale reddish-brown with light streaks extending backward from above and below eye, the upper ending below end of dorsal, the lower extending along middle of tail, a dark band between them and another less distinct below them; belly pale. In some specimens the sides are almost uniformly dark, the dark lateral bands being very indistinct. Middle of caudal fin sometimes slightly pale, but not in all specimens. Dorsal pale, sometimes nearly covered with dark mottlings. Anal pale or white. Upper rays of pectoral yellowish olive, paired fins otherwise pale. Teeth white, reddish at base, one or two canines on one side in some specimens.

150. Scarus cæruleus (Bloch). Dark Blue Parrot Fish.

Coryphæna cærulea Bloch, Ichthyologia, II, 120, taf. 176, 1786 (Bahamas, after Catesby).
Scarus cæruleus, Jordan, Labroid Fishes, 88.

Body ultramarine blue; fins blue, dorsal edged with darker blue, the membrane of spinous dorsal blackish at base; a sky-blue

[redacted]

small, scarcely larger than some of the numerous pores which surround the eye, the anterior round with a circular marginal valve, the posterior oblong with a valve on lower side; eye 1⅗ in snout, low, a line drawn from corner of mouth to angle of opercle passes along lower edge of orbit; jaws projecting, the upper without canines; cheeks with only two rows of scales. Origin of dorsal and root of pectoral in the same vertical, which is anterior to tip of opercle. Tips of last dorsal and anal rays reach base of rudimentary caudal rays. Caudal truncate, slightly rounded when the fin is spread. Back dusky olive, a pale yellowish streak from upper side of eye to upper base of caudal, below this a band similar in color to the back extends from eye to caudal, sides below pale, with an indistinct dusky streak from above pectoral to caudal; a horizontal green stripe from upper end of gill-opening forward through upper edge of eye and across top of snout; another parallel with this from gill-opening through lower edge of eye and around upper lip; lower lip white, edged with green, a green band across chin, and a pair of indistinct green blotches on throat; breast washed with green; base and edge of dorsal and anal green, a broad white stripe through the middle of each; upper and lower rays of caudal white tipped with orange, edged on each side with green, the middle rays pale dusky green, paler at base; pectorals and ventrals white, the former not dusky at base; teeth white.

This species is most nearly related to *Scarus cœruleus*, but differing decidedly in the color markings.

The above description is based on a single specimen 6 in. long.

EPHIPPIDÆ.

152. **Chætodipterus faber** (Broussonet). Portuguese.

Chætodon faber Broussonet, Ichth. Decas., 1, V, t. 4, 1782.
Chætodipterus faber, Jordan & Gilbert, Synopsis, 613.

CHÆTODONTIDÆ.

153. **Chætodon ocellatus** Bloch.

Chætodon ocellatus Bloch, Ichthy., pl. 211, fig. 2, 1787; Eigenmann & Horning, Chætodontidæ, 7.

Dorsal, anal, forehead and edges of gill-covers yellow.

154. **Chætodon striatus** Linnæus. Butterfly.

Chætodon striatus Linnæus, Syst. Nat., Ed. X, 275, 1758 (India); Eigenmann & Horning, Review Chætodontidæ, 8.

Side whitish, with narrow dark lines between the rows of scales, a black stripe from occiput through eye to lower side of head; a

broad dusky band from anterior part of dorsal across sides behind pectoral and ventral, not hiding the longitudinal markings; another similar one from posterior part of spinous dorsal to and across middle of anal; an olive band across caudal peduncle and fins adjacent; soft dorsal and anal light at base, a broad olive band through middle, this edged with black, the tips narrow, yellowish; caudal similar but with an additional colorless margin; olive mottlings at base of caudal; pectoral colorless; ventral plain dusky, lighter at base. In one of the two specimens here noted, there is a large, ill-defined, rosy blotch behind pectoral.

155. Chætodon capistratus Linnæus.

Chætodon capistratus Linnæus, Syst. Nat., Ed. X, 275, 1758 (India); Eigenmann & Horning, Review Chætodontidæ, 9.

156. Pomacanthus paru (Bloch). Angel Fish.

Chætodon paru Bloch, Icth., taf. 197, 1787 (Antilles).
Pomocanthus aureus, Eigenmann & Horning, Chætodontidæ, 12.

Head 3¾, depth 1⅖, eye 3½; dorsal IX, 32; anal III, 24; scales 50 in longitudinal series.

Body a regular ellipse, caudal peduncle short, less than half its depth. Length of head equal its depth below top of eye. Dorsal and anal falcate, the lobes extending beyond caudal, the posterior portion of each rounded. Ventral spine 1¼ in head. Caudal truncate. A broad, sharp spine at angle of opercle, no other spines on head. Lateral line extending to base of caudal fin.

Color, in alcohol: Sides silvery gray, each scale edged with white.

[redacted]

ish-green; chin and narrow line around upper jaw white, end of both jaws very dark.

157. Pomacanthus arcuatus (Linnæus).

Chætodon arcuatus Linnæus, Syst. Nat., Ed. X, 273, 1758 (Indies).
Pomocanthus arcuatus, Eigenmann & Horning, Chætodontidæ, 13.

The young of this species has the tip of the caudal white and the base of the pectoral but slightly yellow. This species is distinguished from *Pomacanthus paru* by its rounded caudal besides other characters, the latter having the caudal truncate.

158. Holacanthus tricolor (Bloch). Rock Beauty.

Chætodon tricolor Bloch, Ichth., pl. 426, 1795.
Pomocanthus tricolor, Eigenmann & Horning, Review of Chætodontidæ, 15.

Head and body in front of a line connecting second dorsal spine, axil of pectoral and second anal spine, lemon-yellow, slightly orange in front of dorsal; pectorals and ventrals lemon-yellow; the caudal similar but thickly covered with reddish-orange dots; remaining part of body, vertical fins and lips black; slightly dusky between eyes; horizontal margins of vertical fins, margin of opercle and preopercular spine reddish; posterior tips of dorsal and anal lemon-yellow; iris yellow-blue above and below.

159. Angelichthys ciliaris (Linnæus). Angel Fish.

Chætodon ciliaris Linnæus, Syst. Nat., Ed. X, 276, 1758 (Indies).

Head 3½, depth 1⅞, eye 4½ in head; dorsal XIV, 21; anal III, 21.

Body oblong, oval; anterior profile straight, steep, sharply convex in front of dorsal; anterior dorsal outline and ventral outline nearly parallel; jaws projecting. Length of head equal to its depth from anterior margin of blue ring in front of dorsal. Snout 2½ in head, the preorbital one-third broader than eye, with one or two indistinct spines. Preopercle with a strong grooved, lightly curved spine at angle, about as long as orbit; five or six short, blunt spines with intermediate minute ones on upper limb, the longest of these spines 6 in the spine at the angle; two or three short, strong spines on lower limb. Interopercle with one or two short spines. Premaxillary very thick, its width above equal to orbit. A furrow from front of eye below nostrils. Interorbital greater than preorbital, equal to distance between eye and upper end of gill-opening. Soft dorsal and anal falcate, the filamentous tips reaching much beyond the caudal. Pectoral broad, obliquely rounded, 1⅓ in head. Ven-

trals long, the spine long, $1\frac{2}{3}$ in head, the rays slightly filamentous, not quite reaching anal, equal to head. Caudal rounded, equal to head behind premaxillary. Lateral line ceasing before reaching end of dorsal, the scales below regularly arranged, those above irregularly.

Color: Ground color olive, terminal half of scales on sides yellow, side of head yellowish-olive, top of head dusky; a blue ring in front of dorsal surrounding a black spot containing a few pale blue specks; iris yellow, blue above and below; upper jaw blue-black, some yellow at corner of mouth; lower jaw, lower side of head and breast dusky olive; a dark blue margin to opercle much broader above than below; upper edge of preopercular spine pale blue; edge of dorsal fins blue-black, a black blotch on last rays, the fins otherwise reddish or orange, becoming paler toward tip of filament; anal similar to dorsal, but darker; caudal entirely pale orange or clear lemon-yellow; pectorals lemon-yellow, the base with a brown blotch bordered anteriorly by a narrow blue stripe; ventrals lemon-yellow, somewhat dusky at base.

TEUTHIDIDÆ.

160. Teuthis bahianus (Castelnau).

Acanthurus bahianus Castelnau, Anim. Nouv. Rares. Amer. S., 24, pl. 11, fig. 1, 1855.

165. Alutera punctata Agassiz. Long Mingo.

Alutera punctata Agassiz, Pisc. Brazil, 1829, 137, pl. 76, very bad.

Head to upper end of gill-opening 3½ in length; depth 2⅓; dorsal I–36; anal 35; orbit 4½ in head to upper end of gill-opening; length of gill-opening 3; caudal 2½ in body; base of dorsal 3.

Profile concave; lower jaw much projecting, teeth in a single series in each jaw; eye 1⅓ its diameter below dorsal outline of body; dorsal spine (broken) situated over middle of eye a little nearer soft dorsal than tip of snout; base of soft dorsal slightly shorter than that of anal; pectoral short, equal to gill-opening, its base under posterior third of gill-opening and anterior margin of eye; caudal peduncle 2½ times longer than eye; caudal long and rounded behind.

Color, in spirits, slaty-brown, darker above, covered with small, round, dark-brown spots, about half as big as pupil; snout dark; dorsal and anal dusky; caudal black.

Here described from a specimen about 9 inches in length.

This species is evidently distinct from the northern *Alutera schœpfi*.

166. Limonacanthus pullus (Ranzani).

Monacanthus pullus Ranzani, Nov. Comm. Acad. Sci. Inst., Bonon., 1842, V, p. 4, taf. 1.

Monacanthus pardalis, Günther, Cat., VIII, 230.

167. Monacanthus hispidus (Linnæus). Mingo.

Balistes hispidus Linnæus, Syst. Nat., Ed. XII, 405 (Carolina).

Several specimens (one dried) 4½ in. long. The snout seemingly more produced, and more concave in profile than the northern form, but otherwise the same. The two males have the side of the caudal peduncle covered with retrorse spinelets, and have a smaller eye than the females. ♂, eye 2½ to 2¾ in snout; ♀, eye 2⅓ to 2⅓ in snout. Covered with small dots which are sometimes arranged in horizontal rows, and irregular dark blotches.

168. Monacanthus ciliatus (Mitchill). Flap Mingo.

Balistes ciliatus Mitchill, Amer. Monthly Mag. and Crit. Review, No. V, Vol. II, Mch., 1813, p. 326 (Strait of Bahama).

Body with dark horizontal bands; caudal with two dark crossbands, one being at the tip; ventral flap washed with yellowish-olive, with a dark blotch in male; fins colorless in females; dorsal and anal tinged with yellow in the male.

OSTRACIIDÆ.

169. Lactophrys triqueter (Linnæus).

Ostracion triqueter Linnæus, Syst. Nat , Ed. X, 330 (India); Günther, Cat., VIII, 256.

170. Lactophrys trigonus (Linnæus).

Ostracion trigonus Linnæus, Syst. Nat., Ed. X, 330 (India); Günther, Cat., VIII, 256.

171. Lactophrys tricornis (Linnæus).

Ostracion tricornis Linnæus, Syst. Nat., Ed. X, 331, 1758 (India).
Ostracion quadricornis Linnæus, Syst. Nat. Ed. X, 331, 1758 (India); Günther, Cat., VIII, 257.

Three specimens, 5½ in. long. Ocelli confined to dorsal region, sides with or without large blotches. A prominent streak under eye, cheeks with blotches or small spots. Some specimens have a row of spots through middle of caudal. Dorsal ridge with or without a spine behind dorsal.

172. Lactophrys bicaudalis (Linnæus). Trunk Fish.

Ostracion bicaudalis Linnæus, Syst. Nat., Ed. X, 330, 1758 (India); Günther, Cat., VIII, 257.

Dorsal ridge sharp, spines of ventral ridges (measured on the outer side) 2½ in head. Plates of carapace closely covered with very small tubercles, these largest in middle of sides. Entire body, tail and caudal fins regularly covered with round, black spots; these [redacted]

in head, the fifth ray from bottom shortest. Upper and lower rays of caudal slightly produced, middle rays even, upper lobe larger, as long as caudal peduncle. Folds on lower part or side of tail extending forward and meeting on chin, a very slight fold on each side of tail above. Small, imbedded, three-rooted spines on the belly between the lateral ridges, not extending on to chin nor to vent, skin otherwise perfectly smooth. Lines of mucous pores as in *Lagocephalus lævigatus;* four short lines enclosing a quadrangular area behind the eye, from the anterior corners of which extends a line surrounding the eye, the posterior inner corners connected by the nuchal line, the lateral line extending from the posterior outer corner. Lateral line extending directly backward till nearly even with the dorsal fins, then curving downward and extending along middle of tail to base of caudal.

Color, in alcohol: Silvery-olive above, clouded with dark olive, a faint greenish-olive area along sides, lower part on side silvery, below white.

This species differs from *L. lævigatus* in the robust body with short caudal peduncle, the merely emarginate caudal fin, and the shape of the pectoral.

Two specimens, 9½ inches long.

174. Spheroides marmoratus (Ranzani). Spiny Back Blow Fish.

Tetrodon marmoratus Ranzani, Nov. Comm. Ac. Sci. Inst., Bonon., IV, 72, pl. 10, fig. 1, 1840 (Brazil).

Head 2¾; depth 4; eye 4½ in head. D. 7; A. 6; P. 14.

Outline of head concave in front of eye; eye full and high, its distance above a line drawn from corner of mouth to upper base of pectoral equal to its longitudinal diameter. Interorbital space very narrow, grooved, its width equal to that of pupil. Snout long, 1⅗ in head. Nostrils at end of a tube, situated about equally distant from end of snout and posterior edge of eye. Gill-opening equal to base of pectoral, but higher. Length of caudal peduncle from anal 2 in head. Length of head equal to half of distance in front of dorsal. Posterior rays of dorsal 1½ in longest, which are 2½ in head. Pectoral very broad, folding fan-like, the margins scalloped, broadly rounded, lowest ray 1⅓ in upper which is 2¾ in head. Caudal fin slightly longer than the distance of its base from dorsal, its rays all of equal length, 1⅘ in head. Prickles on ventral surface between chin and vent, extending on side of head in front of pectoral fin, on side behind pectoral fin to vertical from dorsal, above from nostrils

to dorsal; only the snout, axil of pectoral and caudal peduncle naked. Lateral line very faint, extending obliquely upward from side of snout under eye, then backward, curving slightly downward under dorsal, most distant on side of tail.

Color, in alcohol: Above very dark brown, with black blotches, the sides lighter with very pale reticulations, a series of about a dozen irregular black spots along lower side; below white; caudal slightly dusky, with no indications of bars, other fins colorless.

This species differs from *Spheroides spengleri* in the high and prominent eye, the very narrow interorbital, the strongly concave outline of snout, the extensive distribution of prickles, and in color.

175. Spheroides testudineus (Linnæus). Blow Fish.

Tetrodon testudineus Linnæus, X, 332, 1758; Günther, Cat., VIII, 282.
Sphæroides testudineus, Jordan & Edwards, Proc. U. S. Nat. Mus., 1886, 239.

The specimens here noted have been compared with specimens of *Spheroides annulatus* from various localities on the Pacific Coast. The spots on the sides are much larger in our specimens and the dorsal not so high; height of dorsal 2½ in head, when depressed, reaching about half way to caudal. In the Pacific Coast specimens the height of the dorsal is 2 or slightly less than 2 in head, when depressed, extending over $\frac{2}{3}$ or $\frac{3}{4}$ of the caudal peduncle.

DIODONTIDÆ.

[redacted]

The very small specimens are very dark with small spots as in the adults; fins pale. They have a number of cirri around the mouth, a pair above the eyes being especially large. One pair, those on the chin, remain in the adult.

177. Chilomycterus antillarum Jordan & Rutter, new species.

Allied to *Chilomycterus schoepfi*, differing in having the whole body covered with black hexagonal reticulations instead of parallel lines. This species has been described by Poey, Synopsis Cuban Fishes, p. 429, as "Species dubia, an *Chilomycterus fuliginosus*?"

Supraorbital spines two, one frontal spine, a single spine below and in front of eye, two between eye and gill-opening; interorbital space deeply concave; a transverse series of cirri on chin, and nearly all of the spines along the margin of the belly have cirri, but there are none above the eyes. Spines short and flat.

Color, in alcohol: Above chestnut-brown, paler on sides, yellowish below, the body everywhere covered with reticulating black lines enclosing more or less nearly hexagonal areas somewhat smaller than the pupil; on the belly, lines become heavier, so that Poey's character of "orange spots in a dark back-ground" is not far wrong; an ocellated black spot about the size of the eye above the pectoral, another behind it, and one on each side of the dorsal; a black blotch on chin in front of the row of cirri and another at each end.

Type 5,056, L. S. Jr. Univ.

SCORPÆNIDÆ.

178. Scorpæna brasiliensis Cuvier & Valenciennes. Crimson Poison Grouper.

Scorpæna brasiliensis Cuvier & Valenciennes, IV, 305, 1829.

179. Scorpæna plumieri Bloch. Cockade Lady; Poison Grouper.

Scorpæna plumieri Bloch, Nya Handl. Stockh., X, 234, 1789; Jordan & Gilbert, Synopsis, 680.

Two specimens 10 in. long. Head relatively much wider and supraocular flap much smaller than in a specimen 7½ in. long from Havana, but agreeing otherwise in every detail of structure. Color, head very dark: body dark olive with two large black blotches or bands; one extending from spinous dorsal and the other from anterior half of soft dorsal; caudal pale olive, a black band at base and tip and one through middle; pectorals and ventrals variously mottled with different shades of olive, black and brown · and blotched with white, black and brown, and a

posteriorly; lower margin of gill opening and breast dark reddish-brown; belly pale.

180. Scorpæna grandicornis Cuvier & Valenciennes. Poison Grouper.

Scorpæna grandicornis Cuvier & Valenciennes, IV, 309, 1829.

TRIGLIDÆ.

181. Prionotus rubio Jordan. Red Gurnard; Couke.

Prionotus rubio Jordan, Proc. U. S. Nat. Mus., 1886, 50 (Havana).

CEPHALACANTHIDÆ.

182. Cephalacanthus volitans (Linnæus).

Trigla volitans Linnæus, Syst. Nat., Ed. X, 302 (Tropical Seas).
Cephalacanthus spinarella, Jordan & Gilbert, Synopsis, 738.

GOBIIDÆ.

183. Philypnus dormitor (Lacépède).

Gobiomorus dormitor Lacépède, Hist. Nat. Poiss., II, 599 (Central American Seas).
Eleotris dormitatrix, Günther, Cat., III, 119.

184. Eleotris perniger Cope.

Culius perniger Cope, Trans. Am. Phil. Soc., 1870, 473 (St. Martins).

185. Dormitator maculatus (Bloch).

[redacted]

MALACANTHIDÆ.

190. Malacanthus plumieri (Bloch).

Coryphæna plumieri Bloch, plate 175, 1787 (Antilles).
Malacanthus plumieri, Günther, Cat., III, 359.

BLENNIIDÆ.

191. Labrisomus nuchipinnis (Quoy & Gaimard).

Clinus nuchipinnis Quoy & Gaimard, Voy. Urania, Zool., 255; Jordan & Gilbert, Synopsis, 762.

PLEURONECTIDÆ.

192. Platophrys lunatus (Linnæus).

Pleuronectes lunatus Linnaeus, Syst. Nat., Ed. X, 269, 1758 (Bahamas, after Catesby).
Platophrys lunatus, Jordan & Goss, Flounders and Soles, 43.

193. Platophrys maculifer (Poey). Ringed Sole.

Pleuronectes maculiferus Poey, Mem., II, 316. 1860 (Cienfuegos).
Platophrys maculifer, Jordan & Goss, Pleuronectidæ, 43.

194. Syacium micrurum Ranzani.

Syacium micrurum Ranzani, Nov. Spec. Pisc. Diss. Sec., 1840, 20, pl. 5, (Brazil); Jordan & Goss, Flounders and Soles, 46.

The specimens here noted have not the eyes so nearly even as has the specimen from Bahia, with which they agree otherwise.

Family SOLEIDÆ.

195. Achirus lineatus (Linnæus).

Pleuronectes lineatus Linnæus, Syst. Nat., Ed. X, 268, 1758.
Achirus lineatus, Jordan & Goss, Flounders and Soles, 88.

Eleven specimens, five females, four that seem to be males, and two seemingly immature females. Leaving out of account the latter two specimens, the males can be readily distinguished by the darker color, by the more anterior position of the upper eye, which is half or more than half of its diameter in front of lower, and by the wider gape to the mouth, which extends to below the middle of the lower eye. The females are light in color, the upper eye is anterior to the lower by less than half its diameter, and the angle of the mouth is under anterior portion of lower eye. The two other specimens whose sex could not be determined resemble the females; one is small and certainly immature, but the other is larger, and may be a male.

196. Symphurus plagusia (Linnæus).

Pleuronectes plagusia Linnæus. Syst. Nat., Ed. XII, 455, 1766 (Charleston?).
Symphurus plagusia, Jordan & Goss, Pleuronectidæ, 100.

OGCOCEPHALIDÆ.

197. Ogcocephalus vespertilio (Linnæus). Fishing Frog.

Lophius vespertilio Linnæus, Syst. Nat., Ed. XII, 402.

February 2.

The President, Samuel G. Dixon, M. D., in the Chair.

Twenty-three persons present.

A paper entitled "New Fossorial Hymenoptera from New Mexico," by T. D. A. Cockerell and Wm. J. Fox was presented for publication.

February 9.

The President, Samuel G. Dixon, M. D., in the Chair.

Thirty-one persons present.

February 16.

The President, Samuel G. Dixon, M. D., in the Chair.

Forty-one persons present.

Papers under the following titles were presented for publication :—

"The Anatomy and Development of Spirorbis borealis," by Mary A. Schively.

"Inhumation and Incineration in Europe," by the Marquis de Nadaillac. (By title).

[redacted]

NEW FOSSORIAL HYMENOPTERA FROM NEW MEXICO.

BY T. D. A. COCKERELL AND WM. J. FOX.[1]

Sphærophthalma snoworum n sp.

♂.—Length about 15 mm., anterior wing 11 mm. Head, thorax, antennæ and legs black, with black pubescence; abdomen ferruginous, the basal segment darkened. Head small, rounded; eyes very prominent, shining; pubescence of vertex becoming brownish; antennal sockets directed outward and downward, producing the appearance of a prominent tubercle immediately mesad of the insertion of each antenna, beneath which there is a deep depression, which is smooth and shining; clypeus and cheeks subcancellate with large, close punctures; penultimate joint of labial palpus very broad; first three joints of flagellum about equal in length.

Thorax irregularly cancellate with close punctures, moderately hairy, the pubescence on the prothorax becoming dark brownish. Tegulæ shining black. Middle segment gradually rounded, not carinate at the sides. Wings dark fuliginous, a hyaline streak across the second submarginal cell, and a hyaline spot just outside of it. Three submarginal cells, the second broadly subtriangular; marginal cell not extending further than the third submarginal; second recurrent nervure almost obsolete.

First abdominal segment shaped something like the head of a vulture, its union with the second marked by a deep suture. Pubescence of abdomen tolerably abundant, black on first segment, largely black on dorsum of second, the rest shining ochraceous. Punctuation of abdomen extremely dense, the shining articulating surfaces of the segments minutely transversely striate, no doubt for purposes of stridulation. Apex broad and rounded, with lateral keels.

Hab.—Albuquerque, New Mexico, Aug., 1894 (Snow). It is named after the Snows, father and son, who have contributed so much to our knowledge of the entomology of New Mexico. Near to *S. apicalata* Blake (err. typ. for *apiculata?*) from Mexico, but is larger, abdomen entirely reddish, and lacks the pale pubescence of

[1] The descriptions are entirely drawn up by Prof. Cockerell; my part has been chiefly the comparison of the species with the collection of the American Entomological Society.—W. J. F.

head and thorax. In general appearance it resembles the Mexican *Mutilla cyllene* Cam.

Sphærophthalma donæ-anæ n. sp.

♀.—Length from 8 to 10 mm.; brownish-ferruginous, with black and silvery pubescence, mostly appressed. Head very large, subquadrate, about as large, seen from in front, as the thorax seen from the side; cancellate from a very close punctuation; pubescence partly erect and partly depressed, not dense enough to hide the surface, silvery on cheeks, in front of eyes, on scape and base of mandibles, black on vertex; a small, smooth, shining spot behind each eye; cheeks distinctly keeled, but not toothed; mandibles with a rather large tooth on inner edge, this tooth and all beyond it black; antennæ reddish-brown with blackened tips, first joint of flagellum nearly twice as long as second.

Thorax strongly rugose-punctate, constricted at sides, abruptly truncate behind, with a tubercle at the top of the truncation; nearly as broad behind as in front. Pubescence not dense enough to hide the surface, forming a blackish triangular patch on dorsulum, its apex directed caudad, its base convex; outside of this large patch the whole dorsal area is covered with glittering yellowish-silvery hairs. Elsewhere on the thorax there is little pubescence, except about and just above the legs, where it is appressed, dense and silvery. Legs dark ferruginous, with thin pale pubescence, anterior tibiæ blackish, spines on hind tibiæ tipped with black.

[redacted]

no pale pubescence forming maculation on second dorsal segment; head without pale glittering pubescence to the extent of that in *contumax*.

Mutilla (s. lat.) **sanctæ-feæ** n. sp.

♀.—Length about 6½ mm., slender, head and thorax ferruginous, abdomen black except the first segment, which is ferruginous; pubescence thin, silvery, not hiding the surface. Head rather small, almost circular seen from in front, subcancellate with large punctures, very thinly pubescent, cheeks not keeled; eyes prominent and shiny, as in *Sphærophthalma*, but oval; mandibles black-tipped, and bearing a prominent tubercle on the outer (lower) edge, not far from the base; antennæ furruginous throughout, first joint of flagellum about as long as second. Thorax subcancellate, with very thin erect pubescence, not forming any pattern; seen from above it is little constricted at the sides, and gradually but not greatly narrows caudad, sloping rapidly behind, without any abrupt truncation. The side view of the thorax has the outline of a half-circle. Coxæ, bases of femora, knees and tarsi ferruginous; femora and tibiæ mainly blackish; tibial spines not tipped with black. Abdomen fusiform, moderately shiny, second segment moderately densely punctured, first segment rapidly broadening to second, its suture with it little depressed. Pubescence of abdomen erect and rather conspicuous, on the hind margins of segments 2 to 5 partly depressed and forming rather thin white bands, on the disc of the second segment shorter and blackish. The large, exposed articulating surfaces of the third and fourth segments are minutely transversely striate, that of the third having a sharply-defined median smooth area, wholly wanting on the fourth.

Hab.—Santa Fé, New Mexico, August 5, 1895 (Ckll., 4,260). Superficially resembles *S. virguncula*, but has the abdomen finely punctured and the entire insect is much more slender. *M. sanctæ-feæ* is rather an anomalous little species, for while the eyes are shiny and prominent as in *Sphærophthalma*, it has the oval shape of *Mutilla;* the general coloration, also, recalls some of the species of *Mutilla*. The tubercle on the mandibles is a striking feature. The middle tibia has two spurs.

Ancistromma chilopsidis n. sp.

♀.—Length about 11½ mm., anterior wing 7 mm., smooth and shining, entirely bright ferruginous except the head, which is black except the antennæ and region of the mouth. Front shining, with

a distinct median groove, finely and tolerably closely punctured, a few much larger punctures scattered about; distance between eyes at top fully equal to joints 3 to 5 of antennæ; clypeus, a small supraclypeal area, mandibles except ends, palpi and antennæ ferruginous; clypeus with minute close punctures except in the middle, where they are large and sparse, anterior margin gradually rounded, sublaterally angled, but hardly dentate; antennæ short, scape swollen, with a conspicuous bulla, first three joints of flagellum of about equal length.

Dorsulum with fine close punctures, the mesothorax with thin short reddish-orange pile, not easily noticeable, shining almost silvery just in front of scutellum in certain lights; scutellum not impressed medially; middle segment very finely transversely striate, appearing almost sericeous. Legs quite spinose, the anterior tarsi especially with very long spines, seven on the first joint, and two on each of the following three; hind spur of hind tibia nearly as long as first tarsal joint. Abdomen impunctate, pygidial area not nearly twice as long as broad, very sparsely punctured. Wings hyaline, nervures ferruginous.

Hab.—Rincon, New Mexico, at flowers of *Chilopsis saligna* Don, (Bignoniaceæ), July 5, 1896 (Ckll., B. 4), one specimen only. It is quite distinct from all other species by its coloration; it comes nearest, apparently, to *A. conferta* Fox, which has a black thorax, etc.

Astatus bigeloviæ n. sp.

♀.—Length 11 mm., anterior wing 7½ mm., smooth and shining,

[redacted]

wings fuliginous, marginal cell only a little shorter than the first submarginal, obliquely truncate; second submarginal narrowed above nearly to a point; legs tolerably spiny, first joint of anterior tarsus with four long spines; tibial spurs black; abdomen microscopically tessellate, with a very few scattered punctures on the third to the fifth segments, pygidial area minutely granular, about one-third longer than broad.

Hab.—On *Bigelovia wrightii*, close to the Agricultural College, Mesilla Valley, New Mexico, Sept. 11, 1895 (Ckll., 4,951). Differs from *A. nigropilosus* by the sculpture of the middle segment, which is not obviously reticulate. A specimen of true *nigropilosus* (recognized as such by Mr. Fox) was taken on the campus of the Agricultural College on Oct. 31.

Gorytes bigeloviæ n. sp.

♂.—Length about 10 mm., anterior wing 7 mm., rather slender, black; occiput, sides of face, cheeks, thorax, especially sides and hind end, and abdomen, especially on dorsal segments three and four, hoary from a minute silvery pile; antennæ, clypeus, mandibles and anterior legs, orange-rufous, bright in color except the antennæ, which are dusky-brown above; middle femora and tibiæ obscurely brownish beneath; a narrow line along inner orbits, hind margin of prothorax, tubercles and a mark behind them, obscure spot on tegulæ, spot above base of wings, broad band on scutellum, line on postscutellum, and elongate patch on each side (margin) of middle segment, apical bands on dorsal segments 1 to 5, broad on 1, becoming successively narrower, and a broad interrupted band on the second ventral segment, all creamy-white. Eyes very little converging below, front strongly but rather sparsely punctured, clypeus somewhat convex, scape with an obscure yellow stripe in front, first joint of flagellum only a little longer than second; mesothorax with very large, not particularly close punctures; tegulæ testaceous, with a whitish spot; scutellum sparsely punctured; triangular basal area of middle segment very strongly longitudinally furrowed, the remaining portion obscurely subcancellate; wings hyaline, the marginal cell and a little beneath it fuliginous, nervures piceous, as also the stigma, marginal cell shorter than in some species; tibiæ and tarsi with only the minutest spines; abdomen slender, first segment shaped something like the head of a vulture, strongly bulging at end, its suture with the second, viewed from the side, a little less than a right angle; first two segments with large rather sparse punctures,

second microscopically tessellate; third to fifth segments with smaller, somewhat closer punctures, apical segment microscopically punctulate.

Hab.—On *Bigelovia wrightii,* close to the Agricultural College, Mesilla Valley, New Mexico, Sept. 12, 1895 (Ckll., 5,096). This has something the appearance of *G. fuscus* Tasch., but will be known at once by the coarctate first segment of abdomen, and the color of the antennæ and legs. The submedian cell of the hind wings terminates the merest point beyond the origin of the cubital nervure and the last ventral segment is not bifid, or is the fifth ventral segment armed with a prominence.

Gorytes crucis n. sp.

♀.—Length about 10 mm., of head and thorax 5, of anterior wing 7½ mm., of ordinary build, bright ferruginous, with a broad yellow band on scutellum, and a darker, smooth abdomen. Inner orbits parallel; front minutely granular, with rather large sparse punctures; area between the ocelli black; space between the antennal sockets slightly less than the diameter of a socket; clypeus prominent, shining, its lateral margins with some short silvery pubescence, its anterior margin gently concave; mandibles dark at tips; scape not swollen, second flagellar joint about two-thirds length of first. Prothorax (and tubercles) entirely without pale marking; mesothorax granular, with large not very close punctures; scutellum microscopi-

[redacted]

semblance to *G. phaleratus* (*rufoluteus* Pack.), which was taken by Prof. Townsend at Las Cruces on the same day (Aug. 12), but the latter has a black mesothorax, yellow collar, etc., and has more the appearance of *venustus*.

Passaloecus armeniacæ n. sp.

♀.—Length 5 mm., black; the scape in front, mandibles except their rufescent ends, palpi, and anterior tibiæ in front, pale chrome yellow, and anterior tarsi orange-rufous; tubercles cream-color; tegulæ very pale testaceous with a cream-colored spot. Front roughened from minute close punctures; sides of face, and clypeus to some extent, with brilliant silvery hairs; labrum conspicuously produced, ending in a blunt point at an angle of about 75°. Mandibles bidentate at apex, the inner tooth much the shortest. Dorsulum very closely punctured, with a pair of obtuse but very distinct tubercles; middle segment coarsely reticulate. Wings hyaline, beautifully iridescent, nervures and stigma piceous. Abdomen shining, slightly pruinose, minutely punctured.

Hab.—Santa Fé, New Mexico, flying about the foliage of an apricot tree, July 4 (Ckll., 3,305). Near to *P. annularis*, but dorsulum bituberculate, and its anterior furrows not foveolate; labrum more acute than in *annularis*.

Diodontus leguminiferus n. sp.

♂.—Length about 3½ mm.; black, with a large head and rather slender abdomen; face below antennæ silvery-canescent; mandibles with a yellow streak and rufous tips, palpi pale grayish-brown; anterior knees, tibiæ and first joint of tarsus, and middle tibiæ at base and apex, pale dull orange-rufous; hind tibiæ at base pale brownish-orange, tarsi all brownish. Front microscopically lineolate passing into tessellate, with scattered punctures; antennæ simple; cypleus bidentate-emarginate; dorsulum very minutely roughened, and very distinctly punctured, the punctures very dense in front; middle segment coarsely roughened, irregularly cancellate; tegulæ black; wings hyaline, nervures and stigma piceous; abdomen shining, distinctly but very minutely and not very densely punctured; its outline from the side suggests a ripe pea-pod, hence the specific name. The suture between the first and second segments is quite depressed.

Hab.—Santa Fé, New Mexico, in Mr. Morrison's garden, July 10 (Ckll., 3,447). Comes near *D. flavitarsis* in regard to the simple antennæ, but is much smaller and more slender, and the legs are differently colored.

DEMONSTRATION OF ABSORPTION OF CARBON DIOXIDE AND OF THE GENERATION OF OXYGEN BY DIATOMS.

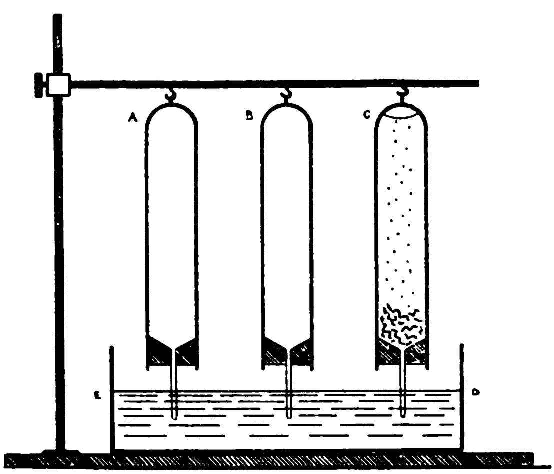
BY T. CHALKLEY PALMER.

The essentially vegetable nature of diatoms is at the present time acknowledged by biologists almost or quite without exception. The phenomena of their increase and reproduction, if nothing else, are of a nature to call for their grouping in the same class with such undoubted plants as desmids and the Zygnemaceæ. Yet every young student, seeing for the first time the glassy cells of diatoms moving about under his microscope in a manner that would seem to indicate a very animal-like volition, is liable to ask for some tangible proof of their plant nature, some more elementary argument than that drawn from relations which are to be apprehended in all their significance only after somewhat extended study.

However difficult, or even impossible, it may be to draw a definite line that shall separate the animal and vegetable kingdoms, it is probable that no one will object if the term plant is applied to an organism which, when exposed to sunlight, is found to absorb carbon [redacted]

animal organisms but with all plants also. It is the well-known process of respiration, that which Gautier has called "the animal life of plants." The method I desire to describe is of great simplicity, and it yields conclusive results within an hour, provided the light be sufficiently strong; it does not necessitate the collection of any appreciable volume of gas, and it demonstrates both phases of the endothermic reaction.

Hæmatoxylin, the chromogen of logwood, is peculiarly fitted to be an indicator in a case where it is desired to recognize the presence or absence of carbon dioxide and the evolution of nascent oxygen, the solvent being ordinary water from spring or river containing its usual traces of various mineral matters. Under the influence of carbon dioxide, the hæmatoxylin dissolved in such water loses its normal rosy or slightly bluish-red tint, and turns to a yellow with a tinge of brown. In the presence of nascent oxygen, on the other hand, the light red hue deepens momentarily, and ends by becoming a very deep blood red. The latter change is in a manner permanent, but the former is reversible, *i. e.* the rosy red color returns when the carbon dioxide is removed. These well-known color reactions are of great delicacy, and are used in the following way:



A sufficient quantity of water is taken to fill all of the tubes shown in the figure, and the dish up to the mark DE. This is tinted with a sufficient quantity of a freshly made solution of hæmatoxylin. The color should be a very pale hue of red. The tube A is tl

filled, and the rubber stopper, with its penetrating quill-tube, is inserted, the last bubble of air is forced out by pressure, and the tube suspended as shown. The remainder of the solution is acidified with carbon dioxide from the lungs, blown into it through a glass tube. The brownish-yellow tint having developed, tubes B and C are filled with the solution, and into C some clean, living diatoms are put. Both are then corked and hung as figured, the quill-tubes dipping below the surface of the liquid in the dish. These quill-tubes, which allow the pressure within the larger tubes, due to gas or to expansion from heat, to relieve itself into the dish, are drawn down to a very small opening in order to lessen diffusion of liquid up or down, and to confirm the diatoms. The apparatus is now exposed to bright light—if to direct sunlight so much the better, since the action is then more rapid. Gas arises from the diatoms in tube C, and simultaneously the color of the liquid, which is at first like that in B, begins to change. Within fifteen minutes, under proper conditions, the color has again become almost or quite as red as that in tube A. The carbon dioxide has now in large measure disappeared from the solution. The action continues, and the color in tube C deepens rapidly, showing oxidation; and this action continues until the color is quite blood-red, or even, in case much lime is in the water, until bluish lakes are formed in clouds. The ceas-

[redacted]

MARCH 2.

MR. CHARLES MORRIS, in the Chair.

Thirty-five persons present.

Papers under the following titles were presented for publication :—

"The Genus Sturnella," by Witmer Stone.

"Diptera Collected by Dr. A. Donaldson Smith in Somaliland, Eastern Africa," by Chas. W. Johnson.

MARCH 9.

CHARLES SCHAEFFER, M. D., in the Chair.

Twenty-eight persons present.

A paper entitled "Underground Runners," by Ida A. Keller, was presented for publication.

MARCH 16.

The President, SAMUEL G. DIXON, M. D., in the Chair.

Sixty-one persons present.

MARCH 23.

MR. CHARLES MORRIS, in the Chair.

Twenty-four persons present.

MARCH 30.

The President, SAMUEL G. DIXON, M. D., in the Chair.

Thirty-five persons present.

Premolars and Form of the Skull.—DR. HARRISON ALLEN proposed to call the teeth back of the canines in Man the premolars, since they are followed in direct infra-position by the teeth of the same name in the permanent set: thus the deciduous series do not possess molars.

He also spoke of the effects of diseased action on the form of the skull. Many of the so-called types were of late origin, due to various phases of malnutrition and were not of much systemic significance.

The following were ordered to be printed :—

THE GENUS STURNELLA.

BY WITMER STONE.

The diversity of coloration in the Meadow Larks included by authors under the name *Sturnella magna mexicana* must have attracted the attention of anyone who has examined a series of these birds.

The range of *mexicana* as given in the American Ornithologists Union Check List, extends northward to the Rio Grande Valley though the larks from this locality are very different looking birds from those which occur in Southern Mexico and Central America.

The Meadow Lark of Southern Florida has also been referred to *mexicana*, but while there is a close resemblance between the two, they are widely separated geographically and their similarity must be considered as a case of parallel development rather than of immediate relationship. The uncertain status of these races seemed to render desirable a careful revision of the genus, the results of which are embodied in the present paper.

For the opportunity of satisfactorily studying the relationships of [redacted]

Aves, II, p. 449, t. 41, f. 1, and in 1816 Vieillot proposed the name *collaris* for it. These names all refer to the eastern bird; *magna* having priority, of course holds for this race.

In 1832 Wagler[2] proposed the name *hippocrepis* for the Cuban Meadow Lark. In 1843 Audubon described[3] *Sturnella neglecta* from the Missouri River above Ft. Croghan. Sclater in 1861[4] called attention to the difference in Meadow Larks from different parts of America, and proposed the names *mexicana* for the bird of Southern Mexico (Jalapa, Cordova and Orizaba) and *meridionalis* for the one inhabiting Colombia and Venezuela.

Later Ridgway proposed the name *inexpectata* for a very small Meadow Lark from Segovia River, Honduras. These six races have been generally recognized, and have usually been ranked as subspecies, though some authors contend that *neglecta* should be considered as a distinct species.

In addition to the forms already described two others have attracted the attention of ornithologists on account of their peculiarities of coloration, but have hitherto for want of better disposition been included under *mexicana*. These are the Florida and Rio Grande Meadow Larks.

Dr. J. A. Allen was the first to call attention to the peculiarities exhibited by the Florida bird (Bull. Mus. Comp. Zool., II, 1871, p. 288), but as he at that time referred all the forms of *Sturnella* to one species, he naturally did not propose a new term for this race. Chapman[5] emphasizes the difference between this Meadow Lark and true *magna*, stating that he is unable to unite them, but on the other hand, considers it impossible to separate the Florida bird from *mexicana*, and so records it under that name, a practice which has been followed by others but which seems never to have been ratified by the A. O. U. Committee, as they do not include Florida in the range of *mexicana* in their new Check List.

The Meadow Lark of the Lower Rio Grande Valley also presents strong points of difference from the recognized forms, and has been recorded under a variety of names.

In 1878 Sennett stated that *magna* was common near Brownsville, Texas, but only one specimen was secured (♀ March 26th),

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[2] Isis, 1832, p. 281.
[3] Bds. Amer., VII, p. 339, pl. 487.
[4] Ibis, 1861, p. 179.
[5] Auk, 1888, p. 273.

and adds that "we did not obtain var. *neglecta*, although it is undoubtedly common."[6]

Dr. J. C. Merrill states that the summer Meadow Lark at Ft. Brown has been identified by Mr. Ridgway as typical *mexicana*. "Its notes and habits do not differ essentially from those of *magna*. Abundant from April until October." A foot note by Mr. Ridgway states that the two specimens examined by him were obtained at Ft. Brown, August 21 and September 13, 1877, and agree exactly with Mexican examples. "They are easily distinguished from true *magna* by smaller general size, including the bill, and much longer legs and feet."

Becham states that all the birds taken or seen by him at Corpus Christi, San Antonio and Beeville (December, 1886, March, 1887) were typical *neglecta*,[7] while Hancock states that *magna* was common at Corpus Christi, but apparently the only bird shot proved to be *neglecta*; nevertheless he says that the song of the bird was much shorter and more feeble in its utterance than *magna*.[8] Rhoads[9] says that he examined a Meadow Lark in the flesh at Corpus Christi (June, 1891) which was undoubtedly *magna*, and that three larks observed during several weeks previous in the same vicinity had the song of *magna*.

In view of these statements the simplest explanation seems to be that while two forms of Meadow Lark are present in winter in the [redacted]

unite these two extremes and also the isolated Florida bird under one name seems to me eminently misleading and quite at variance with our treatment of geographical races of other species.

I therefore propose to separate as a distinct subspecies the Rio Grande Meadow Lark and to place the Florida bird for the present at least along with true *magna*, for reasons that will be stated below. The Rio Grande Meadow Lark may be separated as follows:

Sturnella magna hoopesi subsp. nov.

Type No. 786, coll. Josiah Hoopes. Brownsville, Texas, ♂, March 13, 1892, F. B. Armstrong.

Color below as in *magna*, but rather lighter and less buff on the sides and under tail coverts; upper surface much grayer and generally lighter. The brown tints of *magna* are very largely replaced by gray, especially on the wings. Sides of the face whiter than in *magna;* tail bars almost always distinct, i. e., not confluent along the shaft of the feather.

This bird is the lightest of all the Meadow Larks, averaging a little lighter than *neglecta*, the tail bars are also more distinct than in any of the other races.

A series of females in Mr. Hoopes' collection taken in midwinter, are veiled below with very light (almost white) tips to the feathers, and are even more strikingly different from *magna* than those in breeding plumage, since the latter race in winter is veiled with buffy-brown.

While this race approaches *neglecta* in its general light color, the absence of yellow from the malar region will at once distinguish it. From *mexicana* it differs more widely than from any of the other races, as we have in these two the extremes of dark and light coloration.

The several races of Meadow Larks may then be distinguished as follows:

1. Yellow of throat not spread laterally on the malar region.
    2. Colors of back darker.
        3. Black crescent on breast broader, light streaks above inclining to white, terminal spots on feathers of back generally distinct, *magna.*
        3. Black crescent narrower, light streaks above decidedly buff; terminal spots on feathers of the back

generally reduced and crossed by black markings. All brown markings on wings and back bright *chestnut* brown.

4. Bill very long, *meridionalis.*
4. Bill shorter, *mexicana.*
4. Bill and all dimensions very small, *inexpectata.*

2. Colors of back lighter, all the browns of the upper surface and wings nearly replaced by gray, *hoopesi.*

1. Yellow of throat spread laterally on the malar region; plumage above more gray than brown, *neglecta.*

THE FLORIDA MEADOW LARK.

Judging from a comparison of Florida birds with a series from the Atlantic States to the northward, I was inclined to separate the former as a distinct race, following Chapman's views as to the impracticability of uniting them with *magna.*

They are smaller and darker than *magna*, with the yellow generally more intense. All the feathers of the upper parts have the black areas greater than in *magna*, especially noticeable on the secondaries and tail. On the latter the crossbars are always confluent, and sometimes the black area covers almost the entire feather.

Mexicana differs from the Florida bird in the much narrower breast crescent, the general buff tint in the light markings and the [redacted]

ludoviciana for the southern form since the type locality was Louisiana.

So far as I can judge from the material in hand, I think it hardly worth while to attempt such a division.

The exact relationships of some of the races of *Sturnella* is very easily traced, while in the case of others it is less apparent.

The true *Sturnella magna* is found throughout the eastern United States from Maine southward, and westward to the edge of the Plains. In the southern portion of its range it tends to smaller size and darker coloration, as already described.

To the southwest, *magna* extends into northeastern Texas; one from Jefferson Co. (No. 41,444, Coll. Wm. Brewster) being very similar to the eastern bird. In the Rio Grande Valley, however, the larks pass into a very light race, fully as light as the prairie *neglecta*, with the wings even grayer. This is the form here named *hoopesi*.

The exact range of this bird I am unable to trace; all the specimens I have examined were from Brownsville and Laredo.

In southern Mexico and Central America we find the race *mexicana*, a very dark bird, most nearly resembling the larks from Florida. This, in turn, passes into the South American *meridionalis*, which is of about the same coloration, but differs in its proportions, especially in the very large bill. The peculiar form called *inexpectata* is known only from three specimens from Segovia River, Honduras. They are remarkable for their extremely small size, but resemble *mexicana* in coloration.

On the north *mexicana* probably grades into *hoopesi*, but I have no specimens from northern Mexico showing this gradation. One individual from Huachuca, Arizona (March 1, 1887, male, No. 23,198, Coll. Wm. Brewster), however, may, perhaps, be so regarded. It has the narrow breast band of *mexicana*, and is browner above than *hoopesi* from the Rio Grande Valley, which, in other respects, it much resembles, agreeing strictly with this form in the distribution of yellow on the throat.[11]

Having thus traced the races most clearly connected with *magna* and their offshoots, it remains to speak of the relationships of *neglecta*. This form is found from the eastern border of the plains

[11]Another bird labelled as shot at the same time and place (No. 23,199, Coll. Wm. Brewster) is a typical male *neglecta*. It has the plumage much worn, as in a breeding bird, while in the one referred to above, the plumage is but little worn, agreeing well with November birds from Arizona. It is strange that two such specimens should be taken on the same date!

westward to the Pacific, northward well into British Columbia and southward to southern California, Arizona and northern Texas, passing into western Mexico and southern Texas in winter.

Eastward it occurs more or less numerously as far as Wisconsin, Illinois and Missouri, thus overlapping the range of *magna* through considerable areas.

As I have no new evidence to offer as to the claims of this bird to specific rank, I have let it stand as a subspecies in accordance with the decision of the A. O. U. Check List Committee, though the excessive rarity of specimens intermediate between *neglecta* and *magna* taken in connection with the overlapping of their breeding ranges, seems to me pretty strong evidence of their specific distinction, even though the differences in coloration are slight.

As already stated, so far as my material goes, it seems that *mexicana* (as here restricted) does not occur within the limits of the United States. If my arrangement is adopted therefore, 501a of the A. O. U. Check List will be changed to *Sturnella magna hoopesi* Rio Grande Meadow Lark.

Measurements in inches of the various races of *Sturnella* are appended.

LENGTH OF WING.

	average	max.	min.
S. magna (Pennsylvania) (9 males)	4.88	5.04	4.75
S. magna (Florida) (10 males)	4.35	4.50	4.20

THE ANATOMY AND DEVELOPMENT OF SPIRORBIS BOREALIS.

BY MARY A. SCHIVELY, B. S., M. D.

The following studies upon *Spirorbis* were made during the months of July and August at Woods Holl, Mass. This chaetopod annelid is found attached to the brown alga *Fucus* which grows on boulders and the piles of old wharves in the locality referred to. It is best collected at low tide and seems to limit itself to situations where there is a strong current. The food of the annelid worm consists of infusoria and minute forms of algæ.

From observations made during two summers, and upon material collected from eight localities in the region of Vineyard Sound and Buzzard's Bay, it appears that *S. borealis* has two breeding seasons. One of these extends from the middle of June to the middle of July; the other extends through the month of August. During the last two weeks of July no eggs were found either in the body cavity or in the shell. Examining egg-chains on July 6th, nothing but well developed embryos were found, while on July 31st, the very earliest stages of segmentation and undeveloped eggs were found in abundance.

The shape of the body of *S. borealis* is sub-cylindrical anteriorly, tapering posteriorly; there are two grooves, a ventral and a dorsal, in the latter is found the egg-chain. The outer segmentation corresponds to the inner, the number of metameres and dissepiments varying from 14 to 20. The segments are somewhat narrower on the ventral than on the dorsal side, probably due to the position assumed by the annelid in its shell. The external openings of the segmental organs or nephridia are found on the ventral side near the base of each metamere. On the prostomium are placed eight branchiæ, one of which is modified into an operculum. These branchiæ are branching and filiform, each branching portion being furnished with cilia arranged on either side. The branchiæ are arranged in a circum-oval manner. In the usual position of the annelid in the shell, the branchiæ and operculum only are protruded.

The eggs pass out through the operculum; its end bears a movable translucent plate of lime which protects the animal from

injury after it has withdrawn into its shell, which it does upon the slightest disturbance.

There are two body regions—thorax and abdomen. The prostomium and peristomium are not sharply separated from the succeeding metameres, but are coalesced into a buccal somite. The mouth is circular in form and is placed between two semicircular plate-like areas. The anus appears as a mere slit.

The metameres arise through a process of cell-division from the primitive layer of the undifferentiated mesoderm. The constriction of the metameres begins in the trochophore stage of the worm. The regions or layers of a metamere consist of the following: epithelium or ectoderm, body sac (taking the place of the solid primitive mesoderm), intestinal epithelium or endoderm and mesenchyme cells scattered between these layers.

The parapodia are slightly developed. The upper bear hair-like setæ; the lower consist of transverse ridges. In the adult worm there are three groups of falciform setæ placed on either side of the anterior thoracic region, each group containing from 6 to 12 setæ. These setæ arise from setigerous glands which are follicles formed from proliferation of the outer epithelial cells. Each seta is developed from one of several structural cells. In its growth it breaks through the follicle and extends from here over the surface of the surrounding epithelium. The follicle also projects into the body cavity and [redacted]

For the movement of the branchiæ there are well developed muscle groups. In the free swimming larva, and also in the adult form there are groups of muscles for the movement of setæ.

The egg-chain found in the dorsal furrow consists of from one to four rows, each containing from ten to fifteen eggs. The color of these eggs varies from brown to orange according to the stage of development. Each egg is enclosed in a capsule, while all the ova lie in a common membranous sac. The eggs are telolecithal with considerable nutritive yolk, as the larva does not leave the egg capsule until far developed.

The shell in its earliest formation is trumpet-shaped: later it gradually assumes the tightly coiled spiral form. As in all fixed forms, the body characters undergo considerable modification during development, and these are greatly influenced by the development of a limy covering. The shell gland is placed in the anterior-thoracic region, in the median ventral line.

S. borealis is hermaphroditic, the generative products arising in the walls of the perivisceral body cavity. The reproductive glands are arranged on either side of the intestinal canal near the stomach. Where the ova or sperm is developed is distinguished merely by the presence of the products. The eggs pass into the body cavity and from here into the operculum, where they are fertilized and a capsule secreted; from here they pass out through the opening of the operculum and are placed in the mid-dorsal furrow. The operculum of *S. borealis* does not serve for a brood-pouch as does that of *S. spirillum*.

DEVELOPMENT.

The unfertilized eggs are much smaller in size, have a paler color, and have a much more prominent nucleus than the fertilized eggs. The unsegmented egg has a brown color, the yolk is evenly distributed in large and small globules; the nucleus is very small.

The following table will serve to illustrate the usual length of time occupied by segmentation:—

	Unseg.	2-celled	4-celled	8-celled
(1)	11 A. M.	12 M.	1 P. M.	3.30 P. M.
(2)	11 A. M.	12 M.	1 P. M.	3.30 P. M.
(3)	11 A. M.	12 M.	1 P. M.	4.00 P. M.
(4)	11 A. M.	12 M.	1 P. M.	4.00 P. M.
(5)	11 A. M.	12 M.	1 P. M.	4.00 P. M.
(6)	11 A. M.	12 M.	1 P. M.	4.00 P. M.

All the eggs in the chain are never found to be in the same stage of segmentation. The following will show the typical arrangement: in a chain of 22 eggs, numbers 13, 18 and 20 were unsegmented; 2, 5, 6, 7, 9, 12 and 16 were 2-celled; 14, 3 and 4 were 3-celled; 1, 8, 15 and 22 were 4-celled; 10 was 5-celled. The observation was made at 2 P. M.; by 3 P. M. the successive changes had taken place in all these eggs with the exception of 13, 18, 20, 10 and 14, all of which were probably dead.

The segmentation in *S. borealis* is unequal. The first cleavage plane is equatorial, and takes place as the following will serve to illustrate:

11.00 A. M., egg unsegmented.
11.05 A. M., slight notch visible.
11.30 A. M., segmentation plane visible for one-half the circumference of the egg; polar globules present.
12 M., faint, but complete segmentation plane, 2-celled stage.
1 P. M., marked segmentation plane, resting period.

The egg having passed through the above described changes is now divided into two unequal portions, the smaller of which is ellipsoidal, giving the whole egg a somewhat dumb-bell shaped appearance. The capsule is distinct, but more closely approximated to the surface of the egg than in the preceding stage. There is no marked change in color, the lower larger cell is somewhat darker than the upper.

The successive stages up to the 16-celled stage are shown in the accompanying illustrations, Plate I. The origin of the respective cells is indicated by arrows. The cells of the 4-celled stage are designated A, B, C, D in the order of formation; A′, B′, C′, D′ are successively developed from these in the formation of 5-celled, 6-celled, 7-celled and 8-celled stages. In the same manner *a*, *b*, *c*, *d*, are derived from the previous A′, B′, C′, D′, forming stages 9-celled, 10-celled, 11-celled and 12-celled. The next four stages are designated *a*′, *b*′, *c*′, *d*′, and constitute 13-celled, 14-celled, 15-celled and 16-celled stages in their respective order of formation.

The blastula has a very small blastocoele; the blastopore forms the mouth. The cells of the endoderm take their origin from the macromeres of the lower half of the blastula, while those of the upper half give rise to the ectoderm. The mesoderm can be traced from the left posterior macromere. The blastula becomes bilaterally symmetrical by the rise of the primitive mesoderm cells; these lie in the posterior portion on either side of the median line. Next in development the endodermal cells of the blastula become invaginated into the segmentation cavity and form the archenteron, while the ectoderm grows over the invaginated portion. The primitive mesoderm cells sink between endoderm and ectoderm deeper into the segmentation cavity.

In the gastrula stage the blastophore is a median ventral, longitudinal slit; this closes from posterior to anterior until there remains only a small aperture. The first stage of the larva after segmentation almost entirely fills the egg capsule, and is surrounded by a zone of cilia. The body is opaque, reddish-brown in color, and flattened on one side just below the cilated zone.

In the second stage of the larva the ectoderm becoming invaginated, forms the stomodeum or larval oesophagus; the archenteron elongates backward. There is a central opaque yolk-mass which is surrounded by a layer of clear cells. This layer of clear cells is thickest on the same side that the larva of the previous stage was flattened. The zone of cilia persist and one pair of ocelli appear.

The third stage of the larva has the flattened portion of the body more marked than in the preceding stages. The collar originates as two prominent projections on the right and left of the ventral, posterior, median region of the body.

The prominent features of the fourth larval stage are the increase in the curve of the dorsal surface and the growth of the collar.

In the fifth stage the larva appears divided into three regions: anterior, middle and posterior. The anterior represents the cephalic region, and is separated from the middle by a ring of cilia. The collar covers the whole ventral side of the middle body region; its entire surface is ciliated. The body is of an orange color, while the yolk mass is brown. There is a bright red projection below the collar in the ventral region. Two ocelli are visible.

The sixth larval stage is characterized by the greater development of the collar and the development of hook-like setæ in the lateral portions of the body; three pair of these setæ are arranged between the collar and the posterior portion of the larval body. The primitive body cavity lengthens during this stage. The region of body from the posterior portion to mouth, becomes flattened.

The body of the seventh larval stage is more vermiform; the middle body region being the largest. Four ocelli are present (the larger being the original two) which are placed on the apex of the prostomium in the median line. There is an apical tuft of cilia present and a ciliated post-oral ring. The mouth opens in the median, ventral line and has ciliated lips. The collar is ciliated and now covers only about one-third of the middle body region. The posterior portion of the body is narrower than the middle portion and is segmented; its surface is ciliated on the ventral side and there is a tuft of cilia on the last segment. The posterior end of the intestine opens on the dorsal surface of the last segment by

The formation of the shell was observed as follows: On July 29th at 8.30 P. M. the larva swam slowly about a limited area for about fifteen minutes. It then remained quiet and attached itself to the glass in which it had been placed, after a few minutes it began to secrete a translucent mass about it. At 9.30 P. M. the shell thus formed presented a translucent horn-shaped appearance and formed a permanent tube covering about one-half of the fully extended body. The upper half of the body was constantly protruded from and withdrawn into this half formed shell.

In the ninth stage the shell assumes a spiral form, but is about half the diameter of the adult shell. The annelid still possesses apical ocelli; the collar disappears; the tentacles are filiform and branched. By differentiation of the cephalic region, and by growth of the larva in length of the posterior part of the body, and by segmentation into numerous metameres, the originally unsegmented larva is transformed into the adult annelid.

The time occupied by the development of *S. borealis* from the first segmentation stage to that of the free swimming ciliated larva was found by a series of observations to occupy the space of three days. Two days later the annelids attached themselves and commenced the formation of shells; the length of time required from this stage on to completion of the adult shell has not been observed.

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EXPLANATION OF PLATES I AND II.

Figures 1 to 10.	Segmentation stages.
Figure 11.	Blastula stage.
Figure 12.	Gastrula stage.
Figure 13.	Sixth larval stage. Ventral view. (Still in the egg capsule).
Figure 14.	Seventh larval stage. Ventral view. (Ready to escape from egg capsule).
Figure 15.	Early shell secreting stage. Ventral view.

Figure 16. Later shell secreting stage. Ventral view.

Figure 17. Adult *Spirorbis borealis* showing arrangement of branchiæ, operculum, alimentary tract, shell gland, generative glands.

Figure 18. Cephalic and anterior thoracic regions of adult *S. borealis* showing arrangement of branchiæ and operculum, groups of setæ, fore-gut of alimentary tract.

NOTES ON UNDERGROUND RUNNERS.

BY IDA A. KELLER.

Reduction to types is one of the most characteristic features of modern biological science. That very important branch of botany and zoology which is known as morphology has this for its sole object. In all the variety of form and function which the plant world offers we recognize only a few organs, viz.: root, stem, leaf and trichome as distinct from each other, every part of a plant being simply regarded as one, or a modification of one, of these fundamental forms.

It is the same mental habit by which we are influenced in the formation of our ideas regarding the life history of plants. We are accustomed to unify the cycle of their existence; e. g., we say that, in general, a plant arises from seed, that it produces roots, a stem, leaves and, finally, fruit, when the sequence is repeated. Although in reviewing our past experience we are forced to modify our views upon this subject, we do not hesitate to pronounce the foregoing the typical plan of vegetable existence. The more carefully, however, we investigate the development of plants, the more divergences we find in regard to this recognized fundamental method. Especially among the lower forms of vegetation it may be observed that reproduction by fruit gives way with great frequency to bud formations. Nor in the higher forms is the beginning of the vegetable organism to be found in the ovule as often as we are apt to suppose. Such bud formations find expression here in the production of bulbs, tubers, adventitious buds, runners, etc.

So far as the resulting plant is concerned, there is no difference visible, whether it was produced from seed or bud, and it is not until we unearth roots in great numbers that we begin to realize how great is the importance of the method of reproduction by buds in assisting to clothe the earth with vegetation. Every botanist will readily recall many illustrations of this point. One season I spent much time in studying the formation of runners on the bulb of *Erythronium Americanum*, and the result was surprising. Again I dug up a great number of the scaly bulbs of *Oxalis violacea*, and found hardly one without one or more runners issuing from its base.

It appears probable that these runners with incipient plants or bulbs on their tips, in many cases, appear regularly at certain seasons, and their development *may* be confined to certain periods. I observed the beginning of the formation of runners of *Erythronium* in early April, and their subsequent development which lasted at least until June, when bulbs had formed on the ends. The specimens of *Oxalis* referred to above were collected in June, but I have also found runners on the bulbs of this plant in October. My chief reason for putting these few observations together is to direct attention to these points, since the time favorable for this line of work will soon be at hand. Our spring flowers will, without doubt, prove good objects for investigation. It seems reasonable to suppose that the formation of runners will be found to be most active when the plant is not requiring much energy in seed and fruit formation. This certainly seemed to be the case with *Erythronium*. I do not now remember having found any runners on plants in flower, but I collected scores of plants which produced runners actively, but which had not sent up their flowering scapes.

The following is directly in this line: On the 26th of April of last year I came upon a locality near Swarthmore which was overrun to an unusual extent by *Arisæma triphyllum*. I was struck by the marked difference shown by these plants so far as their respective stages of development were concerned, and began to dig up specimens of various degrees of maturity. Upon examination of a young

[redacted]

Fig. 5 represents a plant of considerably larger size. In other respects it did not differ materially from that represented by fig. 2. Unless the truncate end of the corm may be considered as such, every trace of the appendage was lost. This "cut off" appearance did not belong to the body of the corm, for when the shrivelled coating was removed, the lower end revealed a conical shape—fig. 6.

Fig. 7 shows a plant whose leaves and general appearance indicated a further stage of development, although its growth appeared somewhat stunted. Three large buds *z*, had formed. The specimen was interesting on account of the different relative position of corm, stem and roots as compared with the plants represented in the preceding illustrations. The roots here emerged from the base of the corm, while in the other cases described they proceeded from above. A turning of the corm seemed to have taken place, the point through which the axis of rotation may be considered to pass is evidently at the junction of corm and stem. This apparent rotation is probably due to the position in which the terminus of the runner is primarily lodged. At all events, the subject deserves further investigation. The upright stem in all cases obeys, according to the rule, the influence of negative geotropism, the roots are positively geotropic, but the corm itself seems to be quite free from the influence of this force. Physiologically, this is certainly of interest: I do not now recall any similar observations recorded in regard to the effect of geotropism on bulbs produced from underground runners.

Fig. 8 reprèsents a plant considerably larger than that of fig. 7. The corm here had an appearance of partial rotation, while fig. 9 shows a corm from a plant similar to those of figs. 1 and 2, with the appendage below. It is a question, probably only to be decided by statistics, which is the normal position, if there be such a one, in young and mature plants.

To show the variety of form assumed by the corms of *Arisœma triphyllum*, I have outlined a number of these in fig. 10; *a*, *b*, *c*, *d*, *e*, *f* and *g*, all being taken from flowering plants. Some are flat below, *c* and *f*, others are convex, *d* and *e*. Buds are visible in many cases, *z*, and even in these flowering plants the appendage, *ap.*, indicative of the origin of the plant, is not always lost.

In many other respects, this species is extremely interesting. It is remarkable for its variations in size. I have found specimens

which were considerably over two feet tall, while again one often comes across flowering dwarfs barely six inches high.

I collected, on the excursion above referred to, 25 spikes for examination, and of these 21 were staminate and 4 pistillate. Of the latter closer examination revealed that on 2 of them some few stamens with ripe anther cells were to be found, the anthers being well-filled with pollen, fig. 11, *p*. The anther cells had burst, and there is no reason why the pollen, in such cases, should not fertilize the ovules in pistils on the same plant, especially since small insects are always found inside the spathe, which may serve to distribute the pollen. Possibly these few stamens may help to ensure fertilization in case cross fertilization should fail, which latter method, for aught I know, may be the usual one. The stigma is so remarkable that I could not refrain from sketching it, fig. 12. It is densely covered with enormous club-shaped hairs which are extremely like the glandular hairs I found producing the jelly-like secretion in the fruit of *Peltandra undulata.* Here and there I found a pollen grain on these hairs, *p*.

Finally: From the numbers cited above, although they cannot be taken to represent the ratio in which staminate and pistillate spikes are to be generally found, it appears, nevertheless, that nature wastes a great deal of energy to secure the formation of fruit by such an excessive production of pollen. We may suppose that all these staminate flowers are produced to ensure

especially should it be found, as it is to be expected, that the growth of runners from the development of underground buds is more vigorous when the chief energy of the plant is not consumed in fruit formation.

EXPLANATION OF PLATE III.

Figs. 1, 2, 3, 4, 5, 7, and 8 young plants of *Arisæma triphyllum*, ½ natural size.

Fig. 6, corm of fig. 5, showing conical shape of lower portion after removal of coating; ½ natural size.

Fig. 9, corm with two buds, *z*, and appendage from a plant similar to that represented in VIII; ½ natural size.

Fig. 10, *a*, *b*, *c*, *d*, *e*, *f*, *g*, corms from flowering plants showing a variety of form; ½ natural size.

Fig. 11, pollen grains; the protoplasm is contracted by alcohol; the nucleus, *n*, is very distinct; greatly magnified.

Fig. 12, stigma beset with large club-shaped trichomes, three pollen grains are visible, *p*; greatly magnified.

APRIL 6.

The President, SAMUEL G. DIXON, M. D., in the Chair.

Twenty-nine persons present.

APRIL 13.

The President, SAMUEL G. DIXON, M. D., in the Chair.

Thirty-eight persons present.

Papers under the following titles were presented for publication :—

"A Contribution to the Mammalogy of Central Pennsylvania," by Samuel N. Rhoads.

"A New Southeastern Race of the Little Brown Bat," by Samuel N. Rhoads.

"Contributions to a Knowledge of the Hymenoptera of Brazil, No. 2—Pompilidæ," by Wm. J. Fox.

"Notes on Plant Monstrosities," by Ida A. Keller.

The death, on the 12th inst., of Edward D. Cope, a member, was announced, whereupon the following minute was unanimously adopted :—

The Academy of Natural Sciences of Philadelphia has received [redacted]

One hesitates which to admire most: the tenacity of his memory, the brilliancy of his wit, or the ease with which he used his enormous erudition. To any community, and at any time, the loss of such a man is a calamity.

The Committee on the Hayden Geological Memorial Award reported in favor of conferring the medal and interest on the fund for 1897 on Prof. A. Karpinski, of St. Petersburg, Director of the Geological Survey of Russia.

PROF. KARPINSKI has long been the most prominent figure among Russian geologists, and, in spite of the claims upon his time and energy of the Geological Survey of Russia's gigantic domain—very far the largest region in the world under the direction of a single man—he has found time to contribute valuable additions to our knowledge in many different fields. Some of these are:—

Geological Investigations and Exploration of the Coal Deposits of the Eastern Urals. 1880.

Remarks on the Sedimentary Formation of Russia-in-Europe.

Origin of the Iron Ore in the Donety Basin.

Geographical Observations on the Urals.

Sedimentary Beds of the Tertiary of the Eastern Urals.

Reference to the Occurrence of Permo-Carbonic Measures in Darwazminca. 1884.

Ammonites from the Ural. 1884.

Fossil Pteropods. 1884.

Essay on Unification, etc. 1884.

Geological Map of the Urals. 1884.

Materials for the Study of the Methods of Petrographic Research. 1885.

Geological Map of Russia, Sheet 139.

Orographic Description. 1886.

Prof. Karpinski has been prominent in the councils of the International Geological Congress, his ability and eminence suggesting his selection as the President of the general committee of organization of the coming Congress. The Committee hopes to present farther details of Prof. Karpinski's life at a later date.

APRIL 20.

The President, SAMUEL G. DIXON, M. D., in the Chair.

Thirty-four persons present.

The deaths, February, 1897, of Baron Constantin von Ettingshausen and of Prof. Karl Claus, correspondents, were announced.

APRIL 27.

The President, SAMUEL G. DIXON, M. D., in the Chair.

Twenty-seven persons present.

Papers under the following titles were presented for publication:—

"New Species of Mollusks from Uruguay," by Henry A. Pilsbry.

"External Features of Young Cryptochiton," by Harold Heath.

The following were elected members:—Henry Brinton Coxe, Ferdinand Philips and Eckley Brinton Coxe, Jr.

The following were ordered to be printed:—

CONTRIBUTIONS TO THE LIFE HISTORIES OF PLANTS, NO. XII.

BY THOMAS MEEHAN.

It will be seen by the dates and references in some of the following chapters, that the papers were written long ago. The facts noted have been confirmed by observations made in subsequent years. Some of them have been read at the meetings of the Botanical Section of the Academy, and, though requested for publication elsewhere, have been held so as to appear in this series of "Contributions."

Having been written at various times, when the subjects of the sketches were fresh in the mind, there may be some repetition of propositions. This would not have been the case had the papers been prepared continuously.

THE FECUNDITY OF HELIOPHYTUM INDICUM.

Heliophytum Indicum, the *Heliotropium Indicum* of the older botanists, has found its way over all the tropical and subtropical portions of the earth. It is at home in Asia, Africa and America, and if it once gets a chance seed into the soil of Europe, will no doubt as easily maintain its hold as other free-seeding typical weeds have done. In some unknown way a few plants appeared in 1894 in my garden, and have afforded me an interesting study.

Its capacity for seed production is enormous. The cyme-branches that have flowered and have, or will have, perfect seed, represent, August 28th, a line of 1,224 inches. There are twenty seed vessels, that is to say forty seeds to the inch, making a total of 48,960 seeds. The cymes are still vigorously unfolding and flowering, and will probably double these figures, but in uncertainties it is best to be on the safe side; so, allowing but one-third more, we have a length of fruiting rachis of 1,632 inches, and a total seed production of 65,280.

All this has proceeded from a plant that was itself but a seed three months before! The total length of stem and branches supporting these seed-bearing cymes, is but 396 inches. The plant is true to the classical story of Clytie and Phoebus which gave the original genus *Heliotropium* its name. It does not open a flower until

the sun has reached the summer solstice. When the sun ceases to woo it, the flower opens, only to find its beloved going away. Less than three months of flowering will, therefore, have been occupied in this enormous seed production.

The facts here detailed have an important bearing on two points maintained by me, in connection with the life-history of plants:—

I have recorded numerous observations in the *Proceedings* of the Academy, commencing with 1866, showing that the growth-energy of plants is rhythmic, dependent on the power of the plant, or the parts thereof, to convert nutrition into the growth-force, and that the various forms which plants present are the result of varying phases of life-energy, in most cases of no physiological value, and with which environment has little to do. The evidence furnished by *Heliophytum*, though of a negative character, is surely strong. Through the long ages the plant has been established over a vast area, and consequently subjected to many varying and varied conditions of environment; it has continued as a compact genus or section distinct from *Heliotropium*, without any material change that would warrant a modern botanist in making new species of it.

Again it has been maintained by me that as environment can have no important influence on changes of form, the free and untrammelled production of seed would be of far more importance in a supposed "struggle for life" than any power of adaptation [redacted]

tion that a single flower failed to mature seed. It must certainly be held remarkable that in a single plant, bearing in round numbers over 30,000 flowers, every one should bear two seeds.

It has been contended that though plants may generally self-fertilize when the agents for cross-fertilization do not attend, they are so arranged as to cross-fertilize when the agent does appear. As the *Heliophytum* flowers are freely visited at times on my grounds by insects, and especially butterflies, there might be some strength in the point. I can, however, testify by an almost daily observation of my plant through the season, that minute flowers are only visited by insects when others are scarce. Though I have seen them visiting the flowers for several successive days, there are many days when they do not visit them, and none were noticed on the former until the beginning of August. A careful watching of the anthers shows, however, the extreme difficulty of effecting cross-fertilization. The anthers form a cone over the stigma, and the pollen sacs burst almost simultaneously with the unplaiting of the corolla. When the flower is a few hours old the stigma protrudes slightly through the anther-cap, and is visible under a lens through the very small orifice of the corolla-tube. Even admitting that the flower has not fertilized at this early stage, and that the tongue of a butterfly might introduce foreign pollen to it under certain circumstances, it would rarely, in any case, occur. It is well known that all insects soon discover the easiest method of doing their work. In this case there are five openings between the tube of the corolla and the bases of the filaments, offering a wholly unobstructed course to the creature's tongue. It would have to use considerable force to insert its tongue under the anthers pressing down on the stigma. It is inconceivable that the flower can receive any aid to cross-fertilization in this way. But we may grant that a cross-fertilization will result in a plant better fitted for the struggle for life than one self-fertilized, and that a small percentage might become cross-fertilized. The question of numbers again forces itself upon us. How many of the seeds of any plant get a chance to develop to a plant again bearing seeds? How many of the 65,280 seeds of this plant will probably mature; will come to be seed-bearing plants next year? Only a small percentage, in any case, ever do. In this case surely very few will, and of these how many would those resulting from a "chance cross" give?

Facts of this character are common, but this case presents them in such a remarkable degree, as to make it a special one *Heliophytum indicum*, a self-fertilizer and wonderfully productive, has maintained a remarkable homogeneity amidst rare variation in the environmental conditions.

If we accept the thought frequently thrown out in these contributions that form results from the various degrees of rhythmic energy in the plant itself, just as it would in the formation of the frost crystals on a window pane, we can see that environment can not be regarded as a leading agent, but must take a minor place.

THE ORIGIN OF THE FORMS OF FLOWERS.

In my intercourse with intelligent and observing botanists, who frequently do not place their conclusions on record, I find a growing tendency to discredit views, till recently widely prevalent, that external conditions have any more than a feeble influence on the evolution of the forms of flowers. Thought is in the direction that various degrees of internal energy seem rather the chief agents in effecting change.

Listening to some verbal remarks before the Botanical Club of the American Association for the Advancement of Science, at Buffalo, New York, by Mr. David F. Day, I was struck by his point that irregular flowers were usually associated with the curving or twisting of the peduncle, while regular flowers and straight pe-

[redacted]

casionally occurs on a plant which generally has the pedicels more or less curved. Some Gloxinias and other Gesneriaceous plants will readily recur to the intelligent observer. *Gesneria elongata*, a South American species, popular in garden culture, often has these erect flowers. In this case the flowers are perfectly regular, and of a different character in other respects from the normal ones.

During the past season I was able to add a new illustration to the list in *Pentstemon barbatus*. In a large bed with several hundred flower stems, I collected some twenty erect flowers. In the normal condition, the three lower segments constitute a lip, and are so tightly recurved that they press against the tube; the upper two are erect, and form an upper lip. But in the exceptional flowers noted, this is all changed. The lobes of the corolla are equal, recurved, and pressed against the tube. But the most remarkable change occurs in the fifth or barren stamen. In the normal form this is so differently constructed from the other four that thoughtful observation has to be given before deciding that it is a stamen at all. In these erect, regular flowers there is not the slightest difference between any of the stamens. The fifth is the exact counterpart of the other four. Each one of the five stamens are alternate with the five regular lobes, as they should be in any well-ordered regular flower. Assuredly if a plant always had flowers like these, and only these flowers, it would not be a *Pentstemon*, but be made to constitute a wholly different genus, if it were not, indeed, referred to another natural order, for a two-lipped and more or less irregular corolla is regarded as a leading characteristic in Scrophulariaceæ.

We may say that nothing but a different degree of growth-energy, accelerating or retarding the spiral development, so that that which should have been left curved was advanced to (or left in) a straight condition, had anything to do with the remarkable change.

And then we may ask if such remarkably distinct forms can be produced on the same plant, and in an exceptional way, what is to prevent the plant from regularly exercising the same force, and thus making the irregular flower the exception? That this can be done is shown in the case of the upright and nodding lilies already cited, though we have no evidence that a regular and irregular lily ever grew on the same plant, as here produced by a *Pentstemon*. Examples might be found if carefully looked for.

That these vagaries, once brought into existence, have hereditary powers, is too well known to horticulturists to need more than a

passing notice. That they are not oftener the parents of a line of new species is probably owing to the fact that of the millions of seeds produced by a single plant, an extremely small percentage ever get the opportunity to grow and again develop to a seed-bearing condition. There would be little chance among so many for these exceptional flowers of *Pentstemon* to perpetuate themselves.

Though it would seem that in this case environment, as it is generally understood, could have had little to do in developing an irregular to a regular flower, one may plead for life-energy as the chief factor in the production of form, and still leave considerable for environment to do. One cannot well retain as erect a position when holding an umbrella against a driving storm, as if he were simply shading himself on a calm summer day; and there must be some opposing elements or adverse circumstances capable of depressing life-energy as a mechanical force, and with this variation in degree, we may reasonably look for a change in form. But granting all this it must be evident that life-energy, dependent on varying phases of nutrition, is the main power in deciding form.

SPINES IN THE CITRUS FAMILY.

The spines which often occur in members of the Aurantiaceæ or *Citrus* family are said to be axillary. We are to understand by this that they are situated between the base of the leaf and the axis or stem; but they are rather lateral than axillary. Lateral spines

Examining next some plants of *Triphasia trifoliata* which had wintered in the open air, I was pleased to find the leaf origin of these spines confirmed. The articulation, which the leaves of most of the Citrus tribe have near the junction of petiole and lamina, is plainly seen in these spines (Fig. 1). The part above the articulation is completely dead and brown as one might expect the lamina of a leaf to be—the more highly vitalized spine, the metamorphosed petiole, has resisted the frost killing severity of the winter.

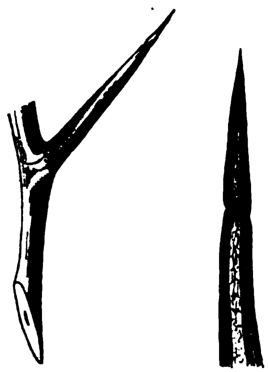

Fig. 1.

We can thus see that the proper classification of the spine in the Citrus tribe is with such as are borne by thistles or similar plants, where the leafy bracts forming the involucres terminate in sharp rigid prolongations, which are not to be classed with spines equally with the sharp apices of *Gleditschia*, *Maclura* and other specifically spiny species.

FLOWERS AND FLOWERING OF LAMIUM PURPUREUM.

One might suppose that a plant so widely spread over the world, and one that intrudes itself so persistently on every one's attention as *Lamium purpureum*, could not possibly have anything written about it that would be new to botanists. But I am inclined to believe that plants have not a uniform behavior in every place, and possibly the behavior of species here may be different from that in the Old World. These considerations make it the more important that the points I have noted in the plants growing on my grounds should be placed on record.

The species is very abundant as a weed on my grounds near Philadelphia. It is the form with the smaller flowers and without the ring of hair below the throat that is described in the typical form of Europe. It was originally introduced into my grounds from Germany. It is probably the form which Willdenow regards as a good species, and describes as *Lamium incisum*. The hair that is found in the throat of *L. purpureum* is absent—there is but a single short tooth instead of two on the lower lip, and the pollen is orange instead of bright scarlet.

Dr. Bromfield notes " anthers with several tufts of stiff hairs or bristles on the face of each cell, and according to Mr. Leighton ac-

companied by 6–8 small, white, oval, tuberculate bodies at their base, but of which I can find no trace in my specimens, and presume they are, therefore, not constantly present." These tubercles are only on one side of the anther, and are easily overlooked. There are always six of these so far as I have examined them; they are, however, easily overlooked as they are on one side only, as already noted. They are very beautiful as seen under a lens, but I have been unable so far to trace their morphological significance. A small gibbosity on the underside of the tube near the base seems to have been overlooked and may also throw some morphological light on the structure of the flower.

An interesting peculiarity is that soon after the ringent corolla opens it separates from the receptacle, the style disarticulating from the carpels at the same time and falling away with the corolla. In most monopetalous flowers the pistil remains after the corolla fades, the corolla usually falling forward and over it. There is rarely any articulation by which the style separates from the carpels as in this case, and as do the stamens in many flowers of other species.

This early fading of the flower and casting off of the pistil, indicates that the flower may have been fertilized before the opening of the lobes of the corolla. An examination shows that this is really the case. When the flower is fully expanded, the stamens are straight, bearing the anthers under the arched upper lip. The anthers will usually be found destitute of pollen, while the longer lobe

brought into contact with the disrupted pollen sacs, and receive an additional supply of fertilizing material, as if nature was taking a double care in this instance that the flower should be self-fertilized. The corolla at this stage seems firmly attached to the receptacle, but very soon afterward it falls at the slightest touch, indicating that fertilization has been perfectly accomplished. An examination of the flowers at this stage will also show that the seeds are wholly mature, and we have to conclude from this examination alone that the fertilization was accomplished in the unopened flower.

CLEISTOGAMY IN UMBELLIFERÆ.

So far as I know no record has been made of cleistogamy in the Umbelliferæ. In 1893 a plant of *Cryptotænia Canadensis* in my garden indicated cleistogamy, but as the flowering period had advanced considerably, further observation was left for the present season.

Cleistógamy, as usually understood, perfects seeds when the generative organs are enclosed in the calyx only, no attempt at forming a corolla being made. In this strict sense the *Cryptotænia* would not be cleistogamous. But the plant has two classes of flowers: one in which the stamens and corolla are highly developed, with the gynœcium abortive, the other with a highly developed gynœcium, stamens with comparatively short filaments, but with polliniferous anthers all enveloped in a corolla extremely fugacious, beneath which fertilization is accomplished before opening. The fine anthers are pressed tightly against the stigma, accomplishing fertilization and inducing carpellary growth before the corolla has reached perfection. When this period has been reached it falls at once, carrying along with it the stamens which have already performed their functions. Though differing somewhat from the usual character of cleistogamy, the action is cleistogamic surely.

The corolla in the male flowers is more enduring than in the female flowers; indeed, as a general rule, it is only the male flowers that we notice in examining the plant. It is extremely rare to find a female flower with an expanded corolla, as it falls very soon after opening, and it was this seeming absence of corollas in the first instance, yet with an abundance of fruit-bearing pedicels, that led to the suspicion of cleistogamy.

The numerous male flowers with even more perfect stamens that are more abundantly pollen-bearing than those in the seed-bearing

flowers, with absolutely no function to perform, present an anomaly, and yet it has a counterpart in the petal-bearing flowers of many cleistogamic species, which I have found rarely seed-producing, though it is customary to refer this class of flowers, in such cases, to an effort on the part of the species to secure an occasional cross. It would rather seem that the true position of cleistogamy in the economy of nature is not yet well understood.

RHYTHMIC GROWTH IN PLANTS.

Though the principle that plant-growth is not continuous but rhythmic must have been long ago observed, I am not aware that any special importance has been attached to it, or of any detailed observations as to the time and manner of the rests and advances until my paper on the Compass Plant, *Silphium laciniatum*, appeared in the Proceedings of the Academy in 1870. I believe it has been left wholly to me to show that rhythmic growth is an important factor in the evolution of form. It is not even yet recognized as it deserves to be. This consideration renders the recording of additional facts desirable.

Dr. Asa Gray, in the *Synoptical Flora of North America*, referring to the natural order Polemoniaceæ, says, "hypogynous disk generally manifest," and "remarkable among the hypogynous gamopetalous orders for the trimerous pistil, but in two or three species of *Gilia* dimerous." "The corolla is not always perfectly [redacted]

believe growth is modified by temperature it may be noted that it was cool for the season—65° F. There was absolutely no growth in the corolla until 9 A. M. Up to this time the corolla was enjoying a rest, but then the lobes began to unfold, occupying about two hours to reach their normal salver shape form. By opening the flowers at various times before 9 A. M. we note that the anthers are not at rest; they are regularly increasing in size. By 9 A. M. they have reached their full development, and the cells burst and discharge the pollen simultaneously with the unfolding of the corolla lobes. By now opening a flower-bud that is a day behind this one in development, we note that while the corolla with its attached stamens was growing, the style was at rest. It evidently starts on its new rhythm of growth the evening before the full opening of the corolla, that is to say when the ultimate length of the latter has been reached, the style starts on its advance. It does not quite reach its ultimate length when the anther cells discharge their pollen, but the appressed stigmas receive and retain the scattered pollen grains. Returning now to the corolla, we find that after full expansion, at about 11 A. M., it continues without change the whole of the next day, withering and falling away on the third. It may be noted, however, that a very light touch causes disarticulation the second day, showing that fertilization has already been accomplished. The lobes of the pistil do not diverge until the second day, but it is evident that fertilization is not dependent on the expansion of the lobes. The pollen tubes act in advance of the expansion of the lobes.

That the morning was rather cool for the season may have been a reason why no insects visited the flowers till noon. Humble bees were the first in the field, rifling the sweets by cutting the tubes of the corolla. The honey bee soon followed, using the slits made by the humble bees, and during the afternoon several species of lepidoptera gathered the nectar by the legitimate entrance.

The nectar is secreted by the "hypogynous disk." It is remarkable, however, that I could find no exudation on the first day of opening. The flow seems to commence on the second day, and is most abundant when the flower is about to wither and long after the fertilization of the flower has been effected. I have already placed this fact on record in connection with *Lonicera* and some other flowers. It is probably a general fact, strangely overlooked in treatises showing the relation of the honeyed secretions to the agency of insects in the cross-fertilization of flowers. So far as the

fertilization of *Phlox* is concerned, every fact pointed to self-action. Insects seem to have no agency whatever in the remarkably prolific results. I have before had occasion to remark that abundant fertility in any plant is always a strong indication of self-fertilization. The "dimorphism" referred to might properly be termed polymorphism. Neither the stamens or pistils can be classed distinctly as long or short, but vary indefinitely. In a white variety of *Phlox pyramidalis* I found the style usually about two-thirds the length of the tube. The stamens too, are very variable even on the same plant. At times only one stamen may be seen at the apex of the throat on a second-day flower. At other times there are three, simulating a three-lobed style. There are, however, always to be seen two shorter than the other three. These two lower and shorter are usually near together, but often widely separated, and occasionally one anther will be sterile. The reflecting observer will have no difficulty in referring all these variations to the varying degrees of rhythmic energy. Whether a growth-rhythm flows gently or is arrested suddenly, decides the direction and degree of the rebounding energy, of which the forms of flowers are but the outward show.

Referring now to the hypogynous disk, or nectary as it might be fairly called, an examination when the seed capsule is nearly mature, shows it to be formed of a fine-toothed membrane, the lobes of which are opposite to the lobes of the calyx. Under morpholog-

as in the formation of the "hypogynous disk," the growth-waves were too weak. They sometimes, however, reveal to us their unsteadiness. I have frequently found but two carpels in some Phloxes, while once in *Phlox Drummondii*, I found four!

With the facts as brought out in the making by nature of Polemoniaceous flowers, we can see how with a little better regulation of the growth-energy other genera and species of plants might have been created which now have no existence. The wholly suppressed series might have been a five-cleft or a gamosepalous calyx,—the "hypogynous disk," petals or a monopetalous corolla, and the present corolla, might have been another series of five stamens. With these changes other combinations appear.

We may also see in a study of Polemoniaceous flowers how the varying rhythmic strength influences the whole form of the flower, as well as the development of its individual parts. Dr. Gray says: "the corolla is not always perfectly regular." The tube of the corolla is slightly curved in most species of *Phlox*. Three longer stamens are always on the upper side of the curve, the two smaller are the lower ones. When the seed vessels of *Phlox paniculata* are nearly mature, the calyx is two-lipped, the three upper corresponding to the upper or outward curve of the tube of the corolla. We may say that it is the irregularity in the growth-waves resulting in organs of varying degrees of development, that cause irregular flowers. We have regular flowers when the growth-waves of a plant are all of a uniform intensity.

PELLUCID DOTS IN SOME SPECIES OF HYPERICUM.

Many species of *Hypericum* present small black dots on the stems, leaves or other portions of the plant. In *H. corymbosum* Muhl., the stem and lower leaves have these dots profusely scattered over the surface, those on the stem being generally somewhat elongated, after the manner of suber cells as usually seen in the young bark or epidermis of woody plants. Examining the series of leaves in succession up the stem, we find the uppermost leaves nearly destitute of black dots, a few being found chiefly near the margin. Starting again from below upward, we find that as we advance the pellucid dots, wholly absent in the lowermost leaves, begin to be comparatively scarce near the midrib. As they come into existence, the black dots disappear. The pellucid dots increase in numbers with each series of leaves—the black dots seem to give up the ground to the pellucid ones—till, when the much reduced leaves beneath the

flower are reached, scarcely any but the pellucid dots are found. They reappear again in numbers on the petals.

It is singular that though there is an evident correspondence in the increase of pellucid dots and the decrease of the black dots, no genetic relationship can be discovered. In no instance was there any evidence of a transmutation of a black dot to a pellucid one.

The dotted structure of other species growing on my ground was therefore examined. These were *Hypericum perforatum*, *H. Buckleyi*, *H. Kalmianum* of our country, and *H. Androsæmum*, *H. calycinum* and *H. Moserianum* of the old world. *H. perforatum* furnished the most interesting subject for comparison. The lower leaves, given up wholly to black dots in *H. corymbosum*, had only pellucid dots, and in none of these were black dots numerous. Indeed, it was only in the uppermost leaves that a few black dots were found, and these sparingly distributed near the outer edges. On the petals also the black dots are sparingly found.

It is apparent from what has been stated in regard to *H. corymbosum* that the energy productive of the black dots is different in degree from that productive of pellucid dots. We may further conclude that these varying degrees of growth-energy had but little to do with the differentiation of these two species. One species could readily be transformed to the other as each degree of energy was in control.

In *H. Kalmianum* and *H. Buckleyi* pellucid dots are profuse. No trace of black dots could be found. From what has been already

[redacted]

mass of reticulated veinlets unequalled in any other species I have seen. Turning to *Hyperium prolificum* I find many semi-pellucid dots in the petals, especially near the margin, and some of them elongated, and in a number of cases they have met others and formed an elongated pellucid vein.

I think these pellucid dots are the initial steps taken by the plant in the formation of veinlets and veins. It cannot for an instant be conceived that nature first makes a skeleton leaf and then covers it with parenchymatous tissue. These strengthening ribs must be constructed out of cell-tissue only as the organism needs them. And this construction can only go on under a regularly arranged system. There can be no theoretical reason against the view I have taken of the nature and office of these pellucid dots.

I think little has been written regarding the variable character of these dots. The only author I have found is Bromfield, who was, in a measure, my early patron and preceptor in botanical study. In *Flora Vectensis*, writing of *H. perforatum*, he takes occasion to note the difference in the character of the dots in various species, which, in some, take the form of anastomosing pellucid veins. "I do not find," he concludes,. "any notice taken of this character by any author I have consulted." I have seen none since his work appeared in 1856.

HONEY GLANDS OF FLOWERS.

It is impossible to take up any subject connected with the behavior of plants without a thought of the wonderful labors of Darwin in the same line. We owe him warmest gratitude for the direction he has trained us to follow. But some of us believe that the great field of vision he opened up to us is broader than ever he himself suspected, and that many more behaviors of plants are to be seen and interpreted than it was given to him to behold and explain. It is, moreover, clear that the *a priori* line on which he started must naturally bias judgment. It is not in human nature to be free from such bias. Feeling that every act and behavior of a plant must originate in a selfish effort for its own good, the doctrine of natural selection naturally followed. The natural condition of life being that of continual war, every effort of a plant was to secure some advantage in this great struggle. Whatever helped this view could not but be welcomed, even by one who was so unusually fair minded as Darwin. Whatever did not accord with his premises, could not be considered as of much importance. Some of us have

departed from the path of our great leader. To us it seems that while selfishness is an undoubted condition of existence, self-sacrifice is equally a natural law. It appears to be the higher development of the original condition—the *raison d' etre* why selfishness exists. Facts which Mr. Darwin would treat lightly, we may be pardoned for desiring to see more clearly elaborated.

The honey glands in flowers have been, in Mr. Darwin's view, so closely related to the encouragement of insect visitors, that their production where they could have little reference to the fertilization of flowers is lightly treated. He refers[1] to an observation of Karr that the bracteas of some orchids secrete nectar, that Fritz Müller has seen a similar behavior in the bract of *Oncidium* in Brazil, and that Mr. Rodgers had seen a similar secretion from the base of the flower-peduncles of *Vanilla*. That he could have seen this frequently in the species of orchids under his own observation is probable. He names *Phaius* as one of the genera in which he examined the flowers for nectar.[2] I am sure I have seen honey glands similarly situated in many orchids, but they are very evident in *Phaius grandifolius*, a common species under cultivation, and probably the one Mr. Darwin had under observation.

I have had before me for a couple of weeks past a Nepalese species not uncommon in gardens, *Cymbidium aloeifolium*, in which the copious supply of nectar from the base of the bract, or rather from the main stem at this point, attracts [redacted]

lines in diameter. It soon hardens on exposure to the atmosphere, and has a high degree of viscidity from its earliest appearance. Considerable force must be exerted in expelling it from the tissues of the plant. Mr. Darwin's explanation is that in these cases the excretion is for the sake of getting rid of superfluous matter during the chemical changes which go on in the tissues of plants. But as starch is necessary for storage, and plants generally have no superfluity of the article, why should the plant labor to form that which, in this case, must be the wholly superfluous article of nectar. To get over this difficulty Mr. Darwin had already suggested that nectar was in the earlier ages of plant life always superfluous. That insect life at first had no knowledge of its existence or value, and that on discovering it, insects and flowers became gradually more correlated.

So far as we can now see these secretions render the plant no service whatever in the great battle of its life, and this Mr. Darwin frankly owns. To him it is an act of excretion of useless matter. To us who believe that individual life is not wholly for itself, but that every act is of some use in the general economy of nature, the new field opened up is one of extreme interest. Observations in this beautiful field are too limited to warrant any general deduction as to the purpose of these stem-bearing glands. The object of this paper is to draw the attention of those who may have orchidaceous plants to a closer examination of their structure, and to encourage a record of such observations.

VARYING PHYLLOTAXIS IN THE ELM.

Calling, a few years ago, the attention of Dr. John Macfarlane, then assistant botanical instructor in the University of Edinburgh, to a bed of one year old seedlings of *Ulmus Americana* and that many of them had opposite leaves, he further observed that each form had been so characterized from the earliest development of the plant. They were either alternate or opposite from infancy, and had adhered strictly each to its separate character through the whole of the first year's growth. This bed of one year seedlings probably contained ten thousand plants. In different parts of this long bed the numbers of each class varied. In places about one-third were alternate leaved, in others the opposite leaves were much more numerous. For the purposes of this paper it may be assumed that about half were of each class.

In another part of my grounds I had about one thousand two year old plants, transplanted the previous spring when one year old. Interested in learning how long the opposite leaved individuals—for I assumed there must have been many of that character—would continue of that class, I found that all but nine had started on the opposite leaved plan from the commencement of the second season's or last spring's growth. These nine continued to form opposite leaves on all the leading branches, but the secondaries which pushed out from the primaries during the summer, had alternate leaves. One may say that by the third year all trace of the opposite leaved system will disappear.

It has been assumed in phyllotaxy that the underlying law in leaf-arrangement is to provide for the very best exposure to the light of the foliar organs. That leaves must have light, and that leaf-arrangement must surely have some reference to this fact, needs no argument to support it. But it must be obvious to an experienced observer that leaves are very far from being always arranged in the best manner to this end. One need never go far for an illustration that if advantageous exposure to light be all that is involved, the plan could be vastly improved. There has always seemed to me fair ground for believing there must be a deeper undiscovered law, and I have been continually on the watch, without [redacted]

In northern regions, in southern Canada for instance, it flowers in June. Under cultivation in eastern Pennsylvania, its flowering season is during the first weeks in May. When the axillary buds of the past season push into growth, some of them seem more vigorous than others. Strange to say these vigorous branches are suddenly arrested at the second node, and, instead of a continuous axillary growth, the cymose inflorescence follows. The flowering is over by the first of June, and the white-berried fruit matures by the first of July. But the weaker growths of the past season are not arrested at the secondary node, but make a continuous growth until the end of June, when the axial growth is also arrested and flowers follow as in the earlier instances. These branches are flowering while the earlier ones are maturing seeds. So suddenly is the axial growth force arrested, that the two axillary buds at the base of the axis, which in the condition of inflorescence becomes the common peduncle, have the growth energy communicated to them, and instead of remaining dormant to make side branchlets for next year, start to form branchlets now. Some idea of the intensity of the growth force, and the suddenness with which the energy was diverted laterally, may be inferred from the fact that these axillary buds, so suddenly called into development, will elongate and form a pair of fully grown leaves by the time the blossoms in the cyme have become fully developed. Except that the cyme, equally with its axis, is somewhat weaker than the earlier ones of the season, there is no material difference in the other portions of the inflorescence. The axillary buds at the base of the earlier blooming cymes push into growth with as much vigor as those on the later blooming branches, and some of these terminate in inflorescence, the flowers blooming in August. The facts furnish excellent illustrations of the influence of arrested or accelerated growth force in changing the character and habits of plants.

Another point I have taken occasion frequently to illustrate is one which I believe to be wholly my own:—that leaves by no means always originate at the node from which they seem to spring, but from some indefinite point in the axis below. In this *Cornus* the sudden arrestation of growth which determines the flowering conditions and the lateral divergence of the growth-energy, produces the union of a portion of the petiole with its axial growth resulting in one of the branches of the cyme. In some cases the arrested leaf-blade will form a bristle-like appendage an inch in

length, slightly expanding to a lamina at the apex. The united portions of the cyme-branch and petiole can be readily traced downward towards the lower node. The separation of the edges results in the usual square stem at this point. It may be remarked here that one of the distinctions between Cornaceæ and Umbelliferæ is the absence of an involucre. But here we find the tendency to dispute even this character with the Umbelliferous order. The cases sometimes given as illustrating such encroachment are not valid, for the so-called involucre of *Cornus florida* results merely from a second growth of bud scales. This occurs in many families of plants, as, for instance, *Pavia, Carya, Fraxinus* and other genera, especially in some hickories, where the rejuvenated bud scales are sometimes as highly colored as in the Dogwood, and go by the name of "Hickory-lilies."

The appressed hair of the leaves and young branches of *Cornus stolonifera* have been referred to as being "straight but fastened in the middle, and thus appear appressed." But many will be noted as having but one arm, which is as much appressed as if it had been fastened at the middle. It is evidently a branched hair. The same general law of sudden arrestation has evidently extended to the hair. The apical growth, suddenly arrested, has driven the energy laterally, resulting in a horizontal growth on either side, as in the forma-

[redacted]

average number of flowers on a well-developed cyme may be one hundred and fifty, it is rare to find a dozen fruits mature. Often there are none. I have not been able to satisfy myself that the anthers discharge their pollen on the stigma before the expansion of the corolla, thus insuring self-fertilization beyond all chances, as I have shown to be the case in many other instances. I have not found pollen in an unexpanded flower, nor any anther that was not covered with pollen in an expanded flower. The discharge of pollen and expansion of the petals is probably simultaneous. The stamens are longer than the style, and one may say, almost with certainty, that the flowers receive only their own pollen. Facts might be adduced in support of the proposition that it was an instance of sterility from the lack of pollen from other flowers, but the weight of evidence will, I think, favor the conclusion that its failure is from abortion. In other words, the sudden arrestation of the growth force disperses the energy into other channels, with sterility as the result.

The winter color of the past season's branches has attracted attention. The rich reddish-brown has given it the popular name of "Red-twigged Dogwood." The manner in which this red tinge is produced is plainly discernible. I have shown in other papers that color in vegetation is mainly an incident in the struggle for life of the various parts of a plant. If we cut off a branch from a tree, it dies without a struggle. If a frost come early in the fall, the leaves blacken and take on no bright tinge. But if we only partly detach a branch from the tree, or if, in the autumn, there is a struggle with physical forces before death finally assumes control, the leaves color. All this I have fully elaborated elsewhere. The same course is evident here. On the young bark, a few white dots appear. These are incipient cork cells. For a while they are inactive. As soon as they begin to develop, the epidermis turns white, and at once a light pink ring encircles the vesicle. When rupture takes place, a pink line extends upward and downward, and from this pink line the reddish tinge becomes gradually diffused. In a short time the whole of the epidermis, both of the young branch and of the petioles, has a reddish-purple tinge. No one who will make a few observations during midsummer will fail to be convinced that the formation of cork cells is a destructive agency, and yet an agency of comparatively slow action; that color is the result of this protracted struggle for life; and that the peculiar action of the cork

cells, varying as it does in almost all plants, each species having its own peculiar method of developing cork cells, fully accounts for the red color of the annual growths in *Cornus stolonifera*.

FOLIAL ORIGIN OF CAULINE STRUCTURES.

The endeavor to conceive axial and foliar organs as morphologically distinct, leads to difficulties easily surmounted by the conception that every part of a plant is but modified leaf-blade. In striving to regard stem and leaf as essentially distinct entities, we become wholly lost in studying the genesis of the tendril, and we are compelled to say of them they "may be axial or they may not. This may ordinarily be determined by position. Any direct continuation of stem or branch must be of an axial nature, that is, of the nature of stem; and the same is true of whatever primarily develops in the axis of a leaf. Conversely, whatever subtends a lateral axis or branch may be taken for a leaf or foliar production being in the place of such."[3] But the difficulty of carrying this idea along to a consistent conclusion becomes apparent at p. 118 of the work cited, where the tendrils of Cucurbitaceæ are pronounced "peculiar and ambiguous, on account of their lateral and extra-axillary position and the manner in which the compound ones develop their branches."

That a leaf and stem must be morphologically the same seems

the branches are comparatively weak, but when they have gathered strength the terminal leaflets develop into a strong tendril. For instance in *Bignonia venusta* "the leaves are opposite; lower ones ternate and without tendrils, upper ones conjugate or pinnate with one pair of leaflets, and furnished with tendrils." The quotation is from the *Botanical Magazine*, Vol. 46, p. 249, so that those who have not the plant at hand, may see the different forms of leaves in the plate. The one leaf has become a petiole, and is again trifid at the apex—these branchlets again becoming leaflets in other species. Whoever has had the opportunity to study some of the strong growing Bignoniaceæ of Central America, must be fully impressed with the woody character of these tendrils. They are as truly ligneous as are those of Vitaceæ, which are conceded to be of axial origin. When, therefore, we find a plant with a leaf normally trifoliate, transform the terminal leaflet into a permanent woody tendril, it is difficult to understand the necessity for the "abnormal and exceptional" view of these cases. If we say leaf-blade is the foundation of all cauline structure, we are not surprised when a leaflet of *Bignonia* becomes of the nature of stem, and we are not left to mere position on the axis before we can determine the origin of what is actually the same thing.

POLARITY IN THE LEAVES OF THE COMPASS AND OTHER PLANTS.

Those who try to live and learn are often suprised to find some conclusion, which in earlier years we thought unassailable, suddenly shattered by the logic of facts. In my own case it is not unusual to note that beliefs which in a limited sphere seemed founded on a rock, were wholly washed out when opposed by a more general application. Of this class is my former faith in the polarity of the root-leaves of the Compass Plant, *Silphium laciniatum*.

It is just as true to-day as it ever was that the root-leaves stand erect instead of curving more or less toward the horizon as the root leaves of most herbaceous plants do, and that the edges of these leaves are in a more or less north and south line. The faces of the leaves are of much the same construction, and are presented to the east and west respectively. It seems very reasonable to suppose that the leaves are polar because of the similarity in the structure of what would usually be the upper and lower surfaces; that because both surfaces are struggling to get to the full light, and having equal power neither can win, and hence the edges must

of necessity be in the northerly and southerly directions. This is the accepted explanation of this supposed polar arrangement.

The first blow to my faith in this doctrine was the observation that though the stem leaves have an equal arrangement of stomata on either surface, just as the root-leaves have, they make no attempt at "polarity." Further than this many Australian and Cape of Good Hope plants have vertical leaves, with an equal distribution of stomata on either surface, but there is no polar direction specially to the edges of the leaves. In our own country the leaves of *Quercus Catesbæi* are all vertical the first year from the acorn, but their edges are directed to any point of the compass. It is evident that we must yet regard the question as to the cause of the northern and southern direction of the leaf-edges in the Compass Plant as an open one.

If we now look over the whole field of Compositæ, it will surprise us to note how many of this order have the whole or portions of the leaf-blade vertical. *Liatris, Lactuca, Chrysopsis, Tanacetum, Cirsium, Centaurea, Boltonia, Silphium, Mulgedium* and *Sonchus* will furnish numerous illustrations. No one can fail to see that this results from a continuation of the spiral growth into the leaf-blade. In many cases there are two spiral twists in a single leaf-blade; the leaves on the flowering stems of these genera are on the ¼ plan. [redacted]

the vertical position is merely the result of vigorous spiral development?

We may get help from the behavior of plants in analogous cases. I observed many years ago, and placed the fact on record in the *Proceedings* of the Academy, that in going across the prairies of Illinois, the earlier flowers of *Helianthus mollis* faced the southeast. This I have confirmed by plants in my garden. Not only is it true of this, but of other species of *Helianthus*. I could travel across the open prairie as well by these flowers as by the leaves of the Compass Plant. The opening flowers of many other species of plants are usually in nearly one given direction. *Digitalis media* of the Old World, has the opening flowers mostly in a direction facing south. I have never found any plant, growing in a fully open place, present any tendency to open its flowers in a northwardly direction.

Now let us for a moment pass to the anthesis of some very early spring flowers. We will take the Goat Willow, *Salix caprea* and the Chinese *Magnolia Yulan*. If the male catkin of this willow be in a position to catch the early morning sun, the catkin has a curve westwardly; if the aspect is such that it cannot get the sunlight till midday, the curve of the apex of the catkin is northwardly. It is exactly the same with the flowers of *Magnolia*. A very slight warmth from the sun at that early stage of the season excites growth, and the development of the flower being greater on the warmed side causes the apex to seem to curve in the opposite direction. We may conclude that some such law prevails in the opening of the sunflowers and others. All plants have varying phases of rhythmic rest and growth; many Compositæ start their daily growth, as I have shown in various papers, soon after sun-rise. A little extra warmth at this time, would throw the greater growth in the easterly direction. A flower, the period of rest of which ceased at noon time, would have its greatest development encouraged in the westerly line.

Just how such considerations as these would affect the root-leaves of the Compass Plant is not clear. But if we imagine, as we may from the facts detailed, that growth in the spring is favored in one point more than others, and that there is a favored resting as well as a growing point, we have a good clue to a sound explanation. I feel assured that the final solution of the peculiar position of the leaves in this plant must be sought for in this direction, and not in any peculiar physiological necessity on the part of the plant itself.

HYBRIDS IN NATURE.

Our gardens abound with hybrid plants. Although the gardener's skill originates them, there seems little reason why they should not occur in nature. The plant desired to produce seed has its flower opened by the hybridizer before it naturally expands; the anthers are removed before the pollen-sacs are ruptured, insects are excluded, and the next day probably, when the stigma is receptive, the foreign pollen is applied. In this way hybrids are secured. From the ease with which hybrids are produced in this way arises the belief that hybridism in nature must be of frequent occurrence.

It is a matter of grave importance that we decide how far this belief is correct. Up to a period not remote, it was a belief that what we know as a species was always a species from the earliest epoch. When a distinct form came under observation that seemed not to have existed from the beginning, it was regarded as a hybrid. It would be accepted as a species, though deemed of hybrid origin. Thus Linnæan nomenclature abounds in "*hybrida*" as a specific denomination. If it can be shown that these are not hybrids, but have been evolved from other species under some regular law of development, the importance of the question becomes apparent.

We now accept the doctrine of evolution as beyond discussion. Species do follow from other species as the world advances; but the old idea is still so prevalent, that many botanists who accept the facts of evolution in a general sense are very apt to regard any unusual departure as a case of hybridism. Our modern literature [redacted]

istic will be irretrievably lost. But the careful student of nature knows that this is not so. The seed collector goes into a wood which may contain White Oak, Black Oak, Scarlet Oak, Red Oak, Chestnut Oak, Swamp White Oak, Post Oak, Black-Jack Oak, Scrub Oak, as he may do along the Wissahickon, gather the acorns of each species under its particular representative, and plant them with the absolute certainty that they will be true to their several parentages. This could not be if the hypothetical proposition cited, of free inter-pollination, were an actual fact.

How, then, are we to account for the striking deviations from typical forms which we occasionally see? I have long believed that form is the result of various degrees of rhythmic growth. It is the mechanical result of varying degrees of energy. These results may be noted on a single tree. On the weaker branches of a white oak the leaves will be comparatively entire; on the stronger shoots, where growth-energy is rampant, the leaves will be deeply lobed. In mulberries these differences must be well known. The leaves on branches full of growth-vigor are lobed, but when this energy is somewhat spent, wholly entire leaves follow. Surely these facts must have come within the range of common observation.

But varying degrees of rhythmic growth may not always result in lobed leaves in its aspects of vigorous growth, or of entire leaves in its weaker ones, because other factors interfere. We may not know just what these incidental forces are, though we may feel sure they exist. For instance, on the common red cedar we may note two distinct forms of foliage: on the weaker, half-starved branches the leaves are like needles and resemble those of the common juniper, but on the more vigorous branches there are seemingly no leaves at all! We have to say "seemingly," for indeed there are really leaves, as really so as on the weaker ones, but the peculiar growth-energy of these more vigorous branches causes them to become connate with the stems. On a branch a year or two old, we can easily separate these connate leaves from the true bark formed beneath.

But that there is no necessity for bringing in hybridity to account for the occasional aberrations from the normal form we meet with is well known to those nurserymen whose business it is to raise trees in great quantities. There are just as many and just as striking variations among genera consisting of a single species, or of species wholly isolated from other species of the genus, as where there are several. The European Oak, Ash, Linden, Beech and many others

furnish illustrations. The English Oak, *Quercus Robur* especially, will furnish scores of variations that have been selected from the seed-beds of nurserymen, and given distinctive names. Many of these differ from each other by characters quite as striking as those which distinguish American Oaks from each other; but we know they are not hybrids because there was no other species with which they could intercross, and they are not regarded as species because of their derivation from *Quercus Robur*. This would not be a true test of specific rank. It still savors of the old doctrine of the special formation of species which we know is not true. With our modern experiences we may expect occasional wanderings from a general character as a result of an unusual expenditure of force. Usually these displays of energy are not able to maintain themselves. Seedlings fall back to the habits of their ancestors. If, however, they should be able to maintain themselves, they are entitled to rank as species. They are species and nothing else.

Seeing, as we must, that all this is so, and must be, why should we refer to hybridity to account for individual changes, especially as the warmest advocates of natural hybridity rarely get beyond "supposition" in any case.

ORIGIN AND NATURE OF GLANDS IN PLANTS.

When treating of glands, authors point out their secretory and excretory functions, and describe their structure and general characteristics, concluding with the bare statement that "besides these

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This season I have had a piece of good fortune; it is interesting enough to give the discovery in detail:—

On my grounds I have a mass of *Cassia Marilandica*, probably fifty plants, covering an area of about sixteen square feet. The leaves are, normally, abruptly pinnate, having a number of pairs of opposite pinnæ with a gland terminating the common petiole. The base of the petiole is tumid, and usually the "gland" arises on the upper surface of the petiole, just above this tumid part. This, however, is not constant. In some cases I found the "gland" a quarter of an inch, a half inch, an inch, and, in a few cases, as much as two inches away. In a few instances they were found with fully-developed pinnæ on either side of them, presenting precisely the appearance of the terminal pair at the apex of the common petiole. As the terminal one has developed with a perfect leaf in some instances, as already noted, it must be assumed that these at the base of the leaf could, under equally favorable conditions, do the same; in their nature they are identical.

Besides this positive proof, the larger basal glands will occasionally furnish strong presumptive proof. These bodies vary much in form, sometimes narrow cylindrical, sometimes nearly globular, at other times are found some remarkably vigorous and ovoid. At the apex may often be seen a pair of small glands in the position that two opposite leaflets would occupy, with a very small gland between, just as we find at the apex of the common petiole. No one comparing such a gland with the apex of a leaf could come to any other conclusion than that the two were normally the same, except that the two leaflets had not developed, leaving only a pair of glands to represent them.

But, it might be suggested, this would only show that the gland was an undeveloped compound leaf; the proof that it was an undeveloped branch would be still desirable. Here we have to fall back on advanced knowledge in vegetable morphology. Most botanists are now prepared to believe that not only are the organs of flowers to be conceived of as modified leaves, but the stem itself comes under the same conception. The cell is the primary plant. Whatever form the plant has to take ultimately, is governed by laws operating in this primary cell. The next step in the conception is the union of cells so as to form leaf-blade, and the next the coiling of leaf-blade to form stem, the upper portion of each coil finally becoming the leaf. There is abundant evidence, no

sary to be reproduced here, that this theoretical conception of the formation of stem by the mere coiling of leaf-blade is legitimate, and we are left only to account for the formation of buds, which are eventually to become branchlets.

The origin of buds is readily accounted for by the operation of rhythmic growth. Growth is not continuous, but progresses by a system of successive waves. The node is at once the resting place of the old wave and the departing point of the new. The axial bud is really the termination of the old growth wave. In many cases during the resting period, it starts rapidly on with the new growth-wave, assuming its original position as the leading shoot, when what might have been the leader from a lower portion of the system of arrested nodes forming the bud, is pushed aside to become what is known as an extra axillary branch. This conception I cannot claim as the belief of "most botanists," as it is essentially my own, supported by facts detailed in many papers, which it is not necessary to reproduce here.

Recalling the evidence directly showing that the "gland" must be a branch arrested in development, and carrying in our minds the theoretical conception of the origin of the stem and buds, we can readily understand how an arrested branch has been enveloped by a coiling leaf-blade or set of leaf-blades on the petioles until all that is left is consolidated apex which we now call a gland, and how glands of this character which appear higher up on the leaf stalks are still

vigorously, the whole system of buds above, arrested in its growth by some varying of rhythmic action, is pushed aside to the "extra-axillary" position.

The character of rhythmic growth-waves has not yet received much attention from vegetable biologists. We know that in the growth of some plants the wave progression seems regular and continuous, and then the form of inflorescence we term centrifugal results; at other times the rest seems but partial and is resumed retro-actively, presenting to us the centripetal condition. Though ignorant of the manner in which these varying phases of rhythmic growth is brought about, there is no question about the fact. The production of the supra-axillary bud into a spine in *Gleditschia* is, therefore, easily explainable. Assuming, as has been done in this paper, that an axillary bud is the termination of a growth-wave, and that the growth which has succeeded in establishing itself as leader pushed the bud—the arrested terminal branch—aside; a lower bud on the arrested branch in the more active line of the subsiding growth-wave, would push into activity sufficiently to become a spine, while all the upper portion of the terminal axis remains for a bud, or, perhaps, a mere "gland." In this case the spine represents a centrifugal growth. But when what appears to us to be a lower bud, but which under the conception here adopted would be an upper one, first pushes, we may regard it as an illustration of centrifugal growth in the bud state.

I may be pardoned for observing with some pride, while making a contribution to the knowledge of other hitherto obscure phases in plant life, that the deductions made in my Salem paper of twenty-four years ago have been fully confirmed.

NUTRITION AS AFFECTING THE FORMS OF PLANTS AND THEIR FLORAL ORGANS.

It is remarkable that while American students of plant life are leaning more and more toward the belief that variation in plant structure is due to varying degrees of life energy, European botanists seem more inclined to search for external conditions as the great factor in these modifications. That internal energy must be influenced to some extent by external conditions is manifest to every observer, but changes brought about by these outside influences are rarely permanent. Efforts have been made to show that acquired characters have become hereditary; but in most of the instances ad-

duced, it has not been difficult to prove that the changes, wholly credited to outside conditions, simply hastened the internal action which could have been taken wholly independently of these conditions.

It has fallen to me to show, first in a paper published in the *Proceedings* of the American Association for the Advancement of Science, 1868, and subsequently in other papers, that form is the result of varying degrees of life-energy, and that the degree of energy is due to the ability of the whole plant or portions of a plant, to elaborate nutritive material. This being true, external conditions may have to do with the supply or the character of plant nutrition, but it is the constitutional power of a plant, or any portion of a plant, to avail itself of nutrition that determines the resulting life-energy.

The present paper has been suggested by reading an excellent memoir in the Linnean Society's *Journal*, Botany, Vol. XXXI.[5] It starts out with this proposition: "The capability of varying is admittedly a general property of all living organisms, but how variation is affected by forces other than natural selection we know but little."

I have shown in my address before the American Association at its Montreal meeting,[6] that variation is an essential condition in the general order of things, and that the reasons for the innumerable variations in the forms of leaves and flowers must be sought for in [redacted]

garden rather shaded, plants from a warm cinder bed, plants under the shade of evergreens, and so on through six others. Though no less than 7,951 flowers in thirteen widely separated genera were examined—5,700 being of the common chickweed—the author states that the results are "insufficient to establish any fact other than that plants do vary," but supports "the main contention of this paper that *the position of the flower on the axis affects the sexual organs if they vary.*" This is simply my own doctrine on the origin of sexes in flowers[7] given at the Salem meeting of the American Association, that the position of the flower on the axis in relation to the supply of nutrition, or the ability of the organs to avail themselves of the nutrition provided, decides the character of the sexual organs.

The laborious and valuable observations in these papers result in showing a correlation in appearance and disappearance of stamens and carpels in their variable species. When the stamens were increased in numbers there would be an increase in carpels and *vice versa.* A change in one organ resulted definitely in a change in others. This I have observed in the common *Dahlia* in gardens. The ray florets in the normal "single" form are pistillate, the tubular disk florets are hermaphrodite. In what are termed "double" Dahlias—that is, when the florets become all ray-like or ligulate—the purely female condition follows with the change from tubular to ligulate. I believe this is true in most cases where the tubulifloral section of Compositæ assume liguliforal conditions, as it is a fact well worth noting in connection with this whole subject that while *Dahlia, Helianthus, Bellis, Chrysanthemum* and numerous other species with normally tubulifloral florets will advance occasionally to the liguliforal or so-called double condition of the florists, I can recall no instance of one normally of the latter class that assumed the tubulifloral or "single" condition.

The observations of Mr. Burkill, as well as my own long-recorded observations, show that the variations in the various organs of plants cannot be accounted for under the chapter of accidents commonly known as natural selection or conditions of environment; but are arranged under a definite plan, governed by the degree and condition of vital energy, and that this energy itself is dependent on the supply of nutrition, including the life-power of the cells interested to avail themselves of it.

[7] See Proc. Am. Assoc., 1869; also American Naturalist, 1869, p. 260.

SOME NEGLECTED STUDIES.

Botanical pleasures need not end with the first frost. Buds and branches furnish an endless variation, and are capable of affording characters quite as reliable as, and, in many cases, more reliable than, those offered us by leaves, flowers or fruit. For morphological or physiological study, a knowledge of the characters presented by buds and branches is invaluable.

A few days ago I came across a very thrifty Pin Oak, about twenty-five years old. Along the smooth, clean trunk, during the past season, a number of weak shoots had grown. I believe we cannot tell how an apical cell, which seems to be required before the growth of the branch can be started, can be formed out of an ordinary wood cell and be able to push its way through a layer of bark a quarter of a century old so as to produce the growth of twigs in question. There is an original field here for study as well as a theme for admiration. Perhaps my own discovery, published in the *Proceedings* of the Academy many years ago, on the nature of warts or excrescences on the trunks of trees, such as we very often see on the Weeping Willow, the Garden Cherry and other trees, may furnish an explanation. It is briefly this: New wood is formed by germination from original wood cells. These are added laterally during the growing season. The last series of cells born of the mother cells at the end of the season become liber cells, and give [redacted]

The young leaves are folded longitudinally. We can see some of the processes by which nature makes *Liriodendron* differ from *Magnolia*, but what induces the curving of the petiole in one instance and the straightening in another we have yet to learn.

Though no reference is made of the fact in descriptive botany, the manner in which the base of the petiole folds over the young bud is distinctive of the genus *Rhus*, or at least, of many species, for I have not examined all. The folding is so nearly complete that no axillary bud is visible. In the winter, after the leaves have fallen, we see by the cicatrices that it was a fold of the petiole and not an absolute over-growth. The cicatrix is precisely like that formed by the fallen leaf of the Horse Chestnut, and adds another suspicion to a list already by no means brief that there is a closer relation between the natural orders Sapindaceæ and Anacardiaceæ than systematists generally believe. Other species of trees, notably the Plane and Yellow Wood, have similar embracing petioles. There seems no physiological advantage in these cases. The young bud must have some protection in infancy, and variety seems an essential part of the order of things. All we can say is that this form of protector is as good as any other. The internal arrangement of the bud in *Rhus* is interesting: Two bud scales meet face to face, and closely press their edges together. The interior is a cavity, but densely filled with short, soft hair.

A Sapindaceous plant allied to the Horse Chestnut, *Kolreuteria paniculata*, a small tree from Japan, has branches interesting from the fact that the petiole disarticulates at a little distance above the base of the petiole, leaving lacunose cicatrices, and giving the branch a singular knobby and rough appearance. Here again the teleologist will be at a loss, and seeing that it is no disadvantage, we can only say that it gives a pleasant variation to the run of life.

I might offer many illustrations, but enough has probably been said to show how much of interest the winter season may afford.

A CONTRIBUTION TO THE MAMMALOGY OF CENTRAL PENNSYLVANIA.

BY SAMUEL N. RHOADS.

In the following annotated list are presented the results of the author's study of the feral mammal fauna of central Pennsylvania during the past four years. The data here submitted is of three kinds: first, that recorded by the author, and based entirely on his own observations in the field; second, that obtained by employed assistants in the field, and verified by specimens and notes in the author's collection; third, notes obtained from other sources, the reliability of which the author has no reason to doubt. In all cases where the presence or distribution of any species rests on the third class of evidence the source of such evidence is stated.

The main sources of information are as follows, in order of sequence:

1. A collecting trip, by the author, to Pine Grove Furnace, Cumberland County, April 11 to 15, 1893. This included a visit to the limestone caves near Carlisle.

2. A collecting trip, by the author, to Round Island, Clinton County, May 25 to June 1, 1896; including a side trip taken to Emporium, Cameron County.

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named above show but slight departure from the typical Alleghenian scenery with which the traveller from Harrisburg to Pittsburg becomes familiar in his westward route along the Juniata River. The whole country is more or less crowded with parallel ranges of mountains running northeast and southwest, much broken by coves and cross valleys whose numerous streams empty, with the exception of those of Cambria and Somerset Counties, into the Susquehanna.

The character of the Alleghenies over this wide area conforms closely to the continuous ridged type of parallel chains rising in long, flat-topped ranges, which rarely present a peak or dome to relieve their rounded, monotonous outlines. Their average height is about 1,200 feet, though an elevation of over 2,000 feet is reached in some localities. With the exception of Sullivan County, nearly the entire region treated in this paper is devoid of lakes, lying as it does almost wholly south of the southern border of the great terminal moraine.

Owing to deforesting and burning of the timber over the whole region, the character, not only of the existing flora, but in greater or less degree of the climate and fauna of the country, is more or less altered from the conditions of 100 years ago.

While this has resulted in the extinction of certain forms of reptiles, birds and mammals from their place in the fauna of Pennsylvania, it has not so affected the smaller mammalia, which continue to find in isolated places the necessary life environment.

Such places it has been the author's endeavor to search out and thoroughly explore, in order to supplement our historic knowledge of the larger exterminated species with reliable facts regarding those whose subterranean and retiring habits, or restricted range, have enabled them to escape the older methods of research.

Central Pennsylvania, with the exception of the lowlands of the Susquehanna below Sunbury and a large part of the Counties of Adams, York, Cumberland and Franklin in the south, is dominated principally by the semi-boreal climate, fauna and flora which Dr. Allen has fittingly named "Alleghenian," as contrasted with the colder "Canadian" of the north and the warmer Carolinian of the south. In the intermediate region between these last we find the most puzzling gradations of animal and plant forms. On the highest elevations, however, faunal distinctions are well marked and in strong contrast with those of the southern lowlands. The most boreal environment encountered in my investigations was at Eaglesmere, in Sullivan County, the only place in which the typical

form of *Peromyscus canadensis* has yet been secured. It is significant that here also is to be found one of the largest tracts of old-growth evergreen timber in the State. It is probable that systematic trapping in the tamarack swamps of the more northern Counties of Bedford and Susquehanna will show this and other "Canadian" species to be abundant. South of this, however, along the entire eastern extension of the Allegheny system east of the main ridge there seems to be an absence of this species, but in Cambria County and in Somerset County, near the Maryland line, there appears in the hemlock forests a form seeming to connect, in its diminished size and darker colors, the Canadian *Peromyscus* with a similar species discovered by the writer in the spruce forests which crown the lofty summit of Roan Mountain, N. Carolina. The Red-back Vole, *Evotomys*, also reappears in Somerset County, the most careful trapping in the intermediate region of Juniata and Huntingdon Counties failing to reveal it. From these facts it would seem that the southern extension of the typical Alleghenian mammals found in the northern counties of the State is confined to a narrow strip of the main western ridge through Clinton, Centre, Blair, Cambria and Somerset Counties into West Virginia. In the latter State, owing to the increasing elevation of the southern Alleghenies, these northern types of mammalian life are enabled to bridge the warm Carolinian zone as far south as northern Georgia, insensibly, but surely, appro-

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1. **Didelphis marsupialis virginiana** (Kerr). Virginia Opossum.

Numerous in the southern valleys, rare on the higher mountains, and not found within the denser evergreen forests of the northern counties. As these are cut off the opossum extends its wanderings into the clearings of mountains where it had hitherto been a stranger. "In Clinton County very rare, one killed in 1895"—Nelson. "Rare, last winter two taken at Emporium"—Larrabee. "Coming in rarely around Eaglesmere in the last six years"—Bennett. "Well distributed throughout the southern Alleghenies"—Ingersoll.

2. **Bison bison** (L.). American Bison.

The former range of the bison eastward along the West-branch of the Susquehanna to the forks of the river below Lewisburg during the present century is conceded by Dr. J. A. Allen.[1] The last buffalo killed in central Pennsylvania was shot about the year 1800, by Col. John Kelly, in Kelly Township, Union Co., five miles from Lewisburg. The former presence of the bison in the western part of Bedford County is attested by the names given to Buffalo Mountain, Buffalo Creek and Buffalo Mills in that County. This forms a connecting link between the numerous herds of buffaloes formerly ranging over the Ohio River drainage in western Pennsylvania and the sparsely scattered bands which may have passed over the watershed into the Juniata valley at this point. The presence of sulphur springs in this vicinity with the associated open glade country is well known to be a favorite place of summer resort for this species, and it is significant that a tributary of the Juniata in Perry County is called Buffalo Creek. For further information regarding the eastward range of the buffalo in pre-Columbian times to the Delaware valley the reader should consult the author's paper in the *Proceedings* of the Academy of Natural Sciences of Philadelphia, 1895, pages 244 to 248.

3. **Cervus canadensis** (Erxl.). Wapiti, American "Elk."

The former range of this animal in Pennsylvania was closely coextensive with that of the Bison, both species using the same trails, feeding grounds and licks among the western Alleghenies and passing thence eastward by the same routes to the Delaware valley. The elk was most numerous among the elevated mountain glades and eastern tributaries of the Allegheny and Monongahela Rivers. It was also fairly abundant in the early part of the century in Clinton,

1.—Mem. Mus. Comp. Zool., 1876.

Potter, Tioga and Lycoming Counties. The latter named regions formed the hunting grounds of my veteran friend, Seth I. Nelson, whose diary between 1831 and 1837 shows that he killed 22 elk during the period. Six of these were killed in 1833. The horns of one of these were so large that Mr. Nelson, who is about 5 ft. 2 in. high, told me he could stand erect beneath the skull when the head was inverted with the antler tips touching the floor. Mr. Nelson stated that one of the last elk known to have been killed in that region was secured on Bennett's Branch in Elk County by a party of Cornplanter Indians about 1865. A hunter named Wilson Morrison brought the carcass of an elk about that time to Lock Haven, claiming that he killed it. But it was afterward understood that he had paid $25. for it to the Indians.[1]

The range of the elk and buffalo into the south central counties of Pennsylvania, east of Fulton County, is very improbable, if, indeed, they ever wandered that far. The main line of their eastern range on Mason and Dixon's line was probably along the valley of Castleman's River in Somerset County and the main ridge of the Allegheny mountain near that place, which formed a continuous trail of safety between their haunts in West Virginia and the Keystone State. North of this region their range probably spread northeastward as far south as the Juniata valley, but by far the largest number did not come south of the east and west branches of the [redacted]

and 76° 30′, where the Virginia Deer does not now exist in a wild state. In some of these it is practically exterminated, occurring in its former haunts only as a straggler. In none of these is it common, even in the most protected wilds.

Of the localities known to the writer, those most frequented by deer are the headquarters of Loyalsock Creek, Sullivan Co., the northern part of Clinton County, and Licking Creek in the northern part of Fulton County.

Seth Nelson (Jr.) killed 23 deer in the fall season of 1873, chiefly in Clinton County. In the period between 1861 and 1865 the deer became so numerous in that county that they greatly damaged the crops, and snaring was employed to diminish their numbers. In contrast with this there were killed in 1895, in his vicinity, all told, only ten deer, and most of these out of season, by wild hounds or pot hunters. The chief agencies in the extermination of deer are forest fires and wandering dogs, both of which pursue their relentless course during the entire year, the latter being ten times as destructive as the gray wolf ever was.

5. **Lepus sylvaticus** Bachm. Carolinian Wood Hare.

With the exception of the deepest evergreen forest areas on the higher mountains, no locality in Pennsylvania is a stranger to this abundant species. In the northern counties, at higher altitudes, it is represented by the following race.

6. **Lepus sylvaticus transitionalis** Bangs. Alleghenian Wood Hare.

Two specimens, almost typical of this subspecies, as described by Mr. Bangs, were recently received from Mr. Nelson, who took them near his home in Clinton County. A specimen from Summit Mills, Somerset Co., taken by Mr. Ingersoll, shows a near approach to the Clinton County specimens; but four others, from the same locality, are nearer *sylvaticus*. As the higher forested mountains are cleared, this is the form of "Cottontail Rabbit" which replaces the now nearly exterminated "Snowshoe Rabbit" or Varying Hare.

7. **Lepus americanus virginianus** (Harl.). Alleghenian Varying Hare.

This southern race of the Northern or Varying Hare is rapidly approaching extinction in the greater part of the Pennsylvania Alleghenies once inhabited by it. In the more retired tamarack and hemlock swamps of the northern counties this hare is fairly numerous, but they remain only in isolated places on the main ridge of the western mountains, southward. In the region traversed by Mr.

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Ingersoll they were not known at Tuscarora, Juniata Co. They were reported as yet occurring in the western part of Huntingdon Co., and in Blair Co., 7 or 8 miles west of Tyrone. The old hunters of southern Cambria County formerly knew of them, but they had been killed off several years ago. The same report applies to Somerset Co., except that some were thought likely to remain on Laurel Ridge in the northwestern corner of the county.

"Becoming rare and local in Clinton Co."—Nelson. "Numerous in Cameron County, but decreasing as the woods are cut off"—Larrabee. "Abundant about Eaglesmere"—Bennett.

8. **Erethizon dorsatus** (L.). Eastern Porcupine.

In the mountains of the northern counties as far south as the West Branch of the Susquehanna the porcupine is frequently met with, and in some localities is quite abundant, as in Clinton and Sullivan Counties. At the present day, so far as records are obtainable, this animal does not occur in southern Pennsylvania, though Mr. Ingersoll was told by a farmer, Abraham Hay, of Summit Mills, that he saw one that was killed near Bakersville, Somerset County, 15 years ago. A mountaineer named Wildmann told Mr. Ingersoll that he had heard of one being killed in northern Juniata County on the Black Log Mountain. East and south of a line connecting the last two places the range of the porcupine probably rarely extended. Statements from hunters in Franklin and Cumberland

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10. **Zapus hudsonius** (Zimm.). Meadow Jumping Mouse.

While reported as a well-known species in all localities, I failed to get any specimens. Mr. Ingersoll secured none during his expedition, perhaps on account of the mice having gone into winter quarters. He heard of them at Tuscarora and at Hopewell, in both cases the meadow species being designated.

11. **Zapus insignis** Miller. Woodland Jumping Mouse.

The first Pennsylvania specimen of this species was taken by my friend, Wm. A. Shryock, near Pocono, Monroe County, and recorded in the *American Naturalist* in 1894. In the summer of 1896 I examined a mounted specimen in the collection of Mr. A. K. Pierce, of Renovo, who stated it was taken in a hemlock ravine near Howard Station, Elk County, a few years previously. Two specimens were taken near Eaglesmere by me in August, 1896.

This species may perhaps be found as far south as Somerset County, along the culminating ridge of Allegheny Mountain, but its predilection for to the northern Alleghenian region seems pretty well proved.

12. **Synaptomys cooperi** Baird. Cooper's Lemming Vole.

The first Pennsylvania record for this mouse was given in my paper on the mammals of Monroe and Pike Counties.[3] Mr. Ingersoll captured five in a springy meadow at the foot of the low mountain near Kring's Station, Cambria County, close to the Somerset County line. They were all taken within a space of 50 acres, in runways among high grass and matted herbage near an old clearing. During the time covered in trapping them about six times as many meadow voles were taken in the same spot. No other specimens have been met with in central Pennsylvania,[4] though the species undoubtedly occurs in isolated places throughout the northern and western parts of the region. The Kring's series agree perfectly with specimens from northern New Jersey and Roan Mountain, North Carolina.

13. **Evotomys gapperi** (Vig.). Gapper's Wood Vole.

Wherever the coniferous woodland remains undisturbed in the Allegheny region this species abounds in moist ravines and swamps. Beyond these situations it rarely wanders, although two specimens were taken on the dry, rocky summit of Negro Mountain, Somerset County, along the wooded cliffs inhabited by *Neotoma magister*.

[3] Proc. Acad. N. Sci., Phila., 1894, p. 391.

[4] A young male specimen just received, was taken in Clinton County, April, 1897, by Mr. Nelson.

Specimens in the author's collection were taken at the following localities: Eaglesmere, Sullivan Co., 4; Round Island, Clinton Co., 3; Summit Mills, Somerset Co., 22. Mr. Ingersoll did not find any in the Alleghenies except at Summit Mills, probably more on account of the lack of suitable environment for them in places visited than because this species is not found in the isolated hemlock swamps which yet exist in Juniata, Mifflin and Huntingdon Counties.

Comparison of a large series of Pennsylvania and northern New Jersey *Evotomys* with series from Quebec shows remarkable external similarity, there appearing no tendency to variation which can be said to be constant.

14. Microtus pennsylvanicus (Ord). Wilson's Meadow Vole.

Abounding in open situations throughout the district up to highest elevations where food supply abounds.

A somewhat remarkable color variation in this unusually constant species is found among the fine series taken in Juniata, Huntingdon, Blair and Somerset Counties by Mr. Ingersoll. Nearly all the specimens, compared with examples from the New England, New Jersey and eastern Pennsylvania, are noticeably browner, even in the half-grown young. About a dozen of the adults are of two shades of umber-brown over the whole upper parts, two from Tuscarora being almost a deep blackish chestnut. It is somewhat remarkable that all these umber specimens, except one from Bedford County, are [redacted]

It is found in all wooded parts of the State, at all altitudes; its range somewhat overlapping that of *P. canadensis* in the borders of the denser evergreen forests of the northern counties. As in the cases already cited under *Microtus pennsylvanicus* there is a strong tendency in the Deer Mice of the Juniata river watershed to assume a darker, deeper shade of brown than the normal colors seen in eastern specimens.

18. Peromyscus canadensis (Miller). Canadian Deer Mouse.

Four typical specimens of this distinct species were taken in the primeval forest about two miles from Eaglesmere. They were not found in a similar forest in Clinton County, *leucopus* only being taken there. It is likely that typical *canadensis* is not found in Pennsylvania except along its northern border, in the most boreal environments of the mountain tops in isolated localities. Along the culminating ridge, southward, it intergrades into the following subspecies, inhabiting the loftier summits of the southern Alleghenies.

19. Peromyscus canadensis nubiterræ (Rhoads).[5] Cloudland Deer Mouse.

Of great interest, as showing the true relationships of the long-tailed, dusky deer mouse of the balsam forests of Tennessee and North Carolina, is a series of 29 *Peromyscus* taken in Cambria and Somerset Counties, Pennsylvania, by Mr. Ingersoll.' Nine of these were trapped at Kring's Station, the remainder at Summit Mills. In size and proportions these are conclusively connectant between the large form found in Canada and New England and the diminutive cloud-dweller of the Great Smoky Mountains. In color the Pennsylvania series shows a marked tendency to assume the dark brown shades of the upper parts, which distinguish *nubiterræ* from the ochraceus gray of *canadensis*. The wide, dark dorsal area characteristic of Roan Mountain specimens is also apparent in those from Somerset County, but the pencil of white hairs at the anterior base of ear in *canadensis*, absent in *nubiterræ*, is retained by all in the series taken by Mr. Ingersoll.

An average of four of the larger adults of *canadensis* from Peterboro, New York, recorded by Mr. Miller, gives the following measurements in millimeters: total length, 190; tail vertebræ, 99; hind foot, 21.5. Similar measurements of four specimens from Somerset County are: total length, 180; tail vertebræ, 91; hind foot, 22; while those of *nubiterræ* respectively are 167, 86 and 21.5. The

[5] *P. leucopus nubiterræ* Rhoads; Proc. Acad. N. Sci., Phila., 1896, p. 187.

skulls of the three series show a parallel gradation in size southward from *canadensis* to *nubiterræ*, but no diagnostic features of a higher grade to distinguish the two extremes. It is of interest to note that the decrease in size of body as the species nears the Carolinas is not correlated by a shortening of the tail and hind feet, but that these members are relatively longest in *nubiterræ*.

Mr. Ingersoll makes the following notes on this subspecies:

"*Peromyscus canadensis* I took only at Krings in Cambria Co. and at Summit Mills in Somerset Co.

"At Kring's they seemed to prefer the most retired and secluded places, especially the narrow and deep wooded valleys with little streams flowing through. The first I caught were in such a place, the timber being mostly oak and beech and maple, with here and there a hemlock. Many old and decaying logs and stumps offered them pleasant homes, and nowhere else in that locality did I find them so abundant, and never did I find any at any great distance from the water, nor more than half way up the low mountain. *Peromyscus leucopus* and *Blarina brevicauda* were also taken in the same places.

"At Summit Mills, a region altogether higher, *canadensis* seemed to have replaced *leucopus* entirely, and there I took them everywhere, in stone walls along the edges of fields grown up to briars and bushes, in oak woods and in hemlock woods, and one in a trap set among the rocks on the top of a mountain for Rock Rats [*N. mag-*

[redacted]

resent all of the above named localities except Graffensburg. Specimens from the latter place were examined by the author.

The hunters in Sullivan and adjoining counties deny the existence of this rat in that region. I could find no signs of them around Eaglesmere. There are undoubtedly connecting colonies of this species along the Blue Mountains from Harrisburg to Massachusetts. Links in this chain have been found at Greenwood Lake, New Jersey, and on the Hudson Highlands, New York. It remains for future investigators to trace their range over the intermediate region and demonstrate the distribution of this large mammal throughout the oldest and most populous mining region of North America, whose very existence as a living species was unknown to naturalists as late as the year 1893!

21. Mus musculus L. House Mouse.

The common name given this little pest is by no means specific of its habitat. Mr. Ingersoll secured a series of 42 in Juniata, Huntingdon and Blair Counties, nearly all of which were taken in fields distant from houses or outbuildings. They were especially numerous in upland meadows, in the runways of *Microtus* and *Blarina*. This experience is, however, exceptional, for in other parts of the State I have only occasionally been troubled by them in such places.

22. Mus decumanus Pallas. Norway Rat.

This species is quite as much at home in the coal and iron mines of the mountains as in the farmer's barns or the crowded wharves of our great cities. It is sometimes found in the same caves with *Neotoma magister*. Which of the two is master I have had no means of determining, but it seems probable that the native animal is able to resist any encroachments on his vested rights. Otherwise it would have long since disappeared from localities it yet inhabits.

23. Mus rattus L. Black Rat.

I was unable to secure any recent records of this once common introduced species.

24. Arctomys monax (L.). Eastern Marmot.

Abundant in all situations. Specimens from the mountains of the northern counties are intermediates, approaching the Hudson Bay form, *Arctomys monax melanopus* (Kuhl.).

25. Tamias striatus (L.). Carolinian Chipmunk.

26. Tamias striatus lysteri (Rich.). Canadian Chipmunk.

Chipmunks from Sullivan and Clinton Counties are intermediate between the southern animal and the Canadian form, *lysteri*. Those

from the southern half of the State are typical *striatus*. The series from Somerset and Blair Counties have darker rusty crowns and rumps than those from Eaglesmere and Round Island.

27. Sciurus ludovicianus vicinus Bangs. Eastern Fox Squirrel.

I have been unable to lay hands on any Pennsylvania specimens of this squirrel except those of the light gray phase presented many years ago to the Academy of Natural Sciences by Drs. Heerman and Woodhouse. The exact locality of their capture is not given.

Mr. Bangs, in his review of the eastern Squirrel,[6] quotes Dr. B. H. Warren in stating that this species "is practically extinct in Pennsylvania, except in the counties of Dauphin and Cumberland." The following notes will be of some value in estimating the status of this animal in the Commonwealth.

Clinton County:—"Not plenty. I killed 3 last fall [1894]"—Nelson.

Cameron County:—"Very rare; have not seen any for years"—Larrabee.

Sullivan County:—"Rare; never seen on tops of the mountains"—Bennett.

Cumberland County:—One reported seen near Pine Grove Furnace in 1892. Nearly exterminated—Rhoads.

Mr. Ingersoll was unable to get any reliable notes of this species in his journey through the central Alleghenies. They are practically extinct in that region.

[redacted]

formulate any rule by which typical *hudsonicus* and its subspecies *loquax* may be distinguished. Strictly comparable specimens taken at the same season in Maine and southern New Jersey are in some cases very similar. The greater relative length of tail and hind foot, however, in the southern animal is fairly diagnostic. The large series taken by Mr. Ingersoll on the mountains of Somerset County are but slightly different from Delaware and Chester County specimens, not sufficiently so to warrant their subspecific separation as expressed by the habitat assigned to each by Mr. Bangs.[7]

It is more reasonable to restrict the habitat of typical *hudsonicus*, as in the case of some other Canadian species ranging into the southern Alleghenies, to the northern parts of Pennsylvania. In this case the *loquax* intermediates of the southern Alleghenies give place on the balsam belts of the Great Smoky Mountains to a dusky, imperfectly differentiated form which differs almost as much from *hudsonicus* as does *loquax*. Some winter skins from Clinton County differ sufficiently in measurements and the character and color of pelage to be classed more properly with *hudsonicus*.

31. Sciuropterus volans (L.). Carolinian Flying Squirrel.

The smaller flying squirrel abounds in the entire region included in this paper. No specimens have been received from the northern counties. A specimen taken near Renovo, Clinton County, in the collection of Mr. Pierce, is *volans*. The result of Mr. Bang's inquiries into the distribution of this animal indicates that the large species, *sabrinus*, will not be found in the State.

32. Putorius vison Schreb. Canadian Mink.

33. Putorius vison lutreocephalus (Harlan). Carolinian Mink.

From the statements of hunters, added to personal experience, the mink may be said to be numerously and evenly distributed over the entire upland and lowland régions of Pennsylvania. Taken as a whole the Pennsylvania minks are more typical of the southern race, but in the northern mountain streams are very near the Canadian type.

34. Putorius noveboracensis Emmons. Carolinian Weasel.

Though rarely seen, this animal is a stranger to no part of the State. In the south its change to the white winter dress seems quite as irregular as the relative severity of the season and amount of snowfall. The winter skins of this animal are often sent to the fur-

[7] Proc. Biol. Soc., Washn., 1896, pp. 159, 161.

riers by Pennsylvania trappers, and in but few instances have I noted any in white pelage.

It is not improbable that *Putorius cicognani*, the small northern species, may be found in boreal Pennsylvania; so far, however, I have been unable to get any record of it.

35. Lutra hudsonica Lacép. North American Otter.

Recent records of this wary animal in many of the streams and lakes of the region are so numerous that it is not necessary to enumerate them here. The otter has by no means been exterminated in any county in central Pennsylvania, though it may rightly be said to be now a rare species, wherever once abundant.

36. Mustela americana Kerr. Canadian Marten.

The following records show that this valuable fur bearing animal has not been wholly exterminated in the Allegheny Mountains.

1. Columbia County:—" Mountains north of Benton "—H. Coward. Skin in collection of the Academy of Natural Sciences, No. 1,563, ♀, captured, as above, in the fall of 1892.

2. Sullivan County:—" One was trapped last winter (1895–'96) near Eaglesmere "—Bennett.

3. Clinton County:—" Once abundant in the beechwoods of this and adjoining counties, now very rare; saw tracks of two in Clinton County, winter, 1895 "—Nelson.

[redacted]

every hunter with whom I have communicated; and many men of middle age, who have had twenty years' experience in mountaineering, never saw the track of one where they were formerly numerous, while many other trappers had not even heard of such an animal.

The elder Seth Nelson caught many of them in the beech woods of Potter and Tioga Counties, between the years 1827 and 1845.

Mr. Larrabee, of Emporium, Cameron County, declares there are yet a few in Shippen Township. The tracks of one were seen, and traps set to catch it, during the winter of 1895–'96.

A mounted specimen, taken in Pennsylvania, is in the Academy of Natural Sciences. It has no more definite data, and was evidently taken many years ago.

On March 11, 1896, a fine male Pekan was shot by Christ. S. Nunnemacher on the borders of a wood on Mill Creek, 2 miles north of Bird-in-Hand, and about three miles east of Lancaster, Lancaster County. Mill Creek rises in the Welsh Mountains. This animal had been making depredations on the farmer's poultry in that vicinity for some months, and was finally discovered by some dogs in company with Nunnemacher. The animal was taken to Dr. M. W. Raub, of Lancaster, to be mounted, and the stuffed specimen is now in his possession. In a letter from Dr. Raub I have received full confirmation of the above facts, and unmistakable evidence that the animal was *not* a "Marten," as reported in the Lancaster newspapers of that date.

38. Mephitis mephitica (Shaw). Canadian Skunk.

39. Mephitis mephitica elongata Bangs. Carolinian Skunk.

Central Pennsylvania presents us with two forms of skunks, neither of which are typical of the above species and subspecies as defined by Mr. Bangs.[8]

In Clinton County Mr. Nelson states that only about 1 in 20 are black with a small white head spot. These are of double value as fur.

This animal is equally abundant at all elevations, in deciduous forest growths.

40. Procyon lotor (L.). Raccoon.

Though not often seen, the Raccoon continues to exist in thickly populated districts where forests continue to afford some shelter. Although much sought after by trappers and hunters it holds its own in all sparsely settled districts, both mountain and lowland.

[8] Proc. Bost. Soc. Nat. Hist., 1895, pp. 1–7.

41. Ursus americanus Pallas. American Black Bear.

Several bears are trapped every year in central Pennsylvania, and some of these generally reach the Philadelphia market during the winter. It is a good rule that where one finds the Virginia Deer there are pretty sure to be some bears, and where the former are exterminated the bears are very scarce or never seen.

There is probably not a county coming within the scope of this paper, in which the black bear has been completely exterminated. They are, perhaps, more numerous in the counties surrounding Clinton County than elsewhere. Seth I. Nelson and his son concur in the belief that bears have been more numerous in the past 15 years than before that time, the clearing of the evergreen timber and increase of brush land and deciduous forests being to their advantage. About the year 1883 the junior Nelson killed 7 bears in East Keating Township, Clinton County, alone. In 1893 he killed 4. I examined the pelts of several recently taken by Mr. R. W. Bennett, near Eaglesmere, where they also seem to be numerous.

42. Urocyon cinereoargenteus (Müll.). Northern Gray Fox.

Though very rare in the mountains of the northern tier of counties, this species may be said to visit every township in the state. It is probable that this statement could not have been made 20 years ago, but the destruction of the forests in this, as in other cases, has made possible such an extension of the range of the gray fox into the once

It is well known that the wolf is frequently noted in the Allegheny Mountains of West Virginia, and the nature of the country lying between these and the wilds of western Pennsylvania so favors communication between the two that it requires no stretch of fancy to understand how these crafty wanderers yet defy extermination.

Cameron and Potter Counties:—"Practically exterminated. One hunter saw wolf tracks a year ago [1895]"—Larrabee. "One seen in Potter County recently"—Nelson. This was previous to 1893. "I was told by 3 men that they saw 2 wolves catch and kill a deer in Wyckof Run [Gibson Township, Cameron Co.] alongside of the lumber railroad"—Nelson. No date of this occurrence was given, but it was furnished among some notes of recent records. "I heard a man on Kettle Creek killed a wolf this fall [1896] in Potter County, but I can't find out his name"—Nelson.

Clearfield County:—"The last wolf was killed in Clearfield County with a club by a man on horseback the winter of 1891–'92. It was killed by William Bonsall of the same county"—Nelson.

Clinton County:—"I have been told by 2 hunters that they saw 2 wolves this winter [1893–'94] about 6 miles from my place [Round Island], but I have been all through that woods, and see no signs of anything but lynx, wild cats and foxes. I think it was lynx they saw instead of wolves"—Nelson.

Elk County:—"A wolf was killed in Elk County about 9 years ago [1887 ?] by a deer hunter"—R. B. Simpson.

Sullivan county:—"Long since exterminated"—Bennett.

It may be stated in this connection that a wolf was killed at Prompton, in Wayne County, in the winter of 1897 by Daniel Routan. "It was run in from York state by a hound"—G. D. Stevens. Mr. Nelson also informs me that he has heard of wolves being seen recently in Erie County.

45. Lynx ruffus (Gueld.). Eastern Bay Lynx.

The wild cat is quite abundant in the denser forests of the State, and often lingers close to long established centres of population in the mountain country.

46. Lynx canadensis Kerr. Canada Lynx.

Although the majority of reports concerning the existence of this animal in Pennsylvania relate to the bay lynx or wild cat there is no doubt that the Canada lynx formerly visited the more boreal portions of the north country.

Mr. Larrabee, who recognized the specific distinction between the two, told me that he knew certainly of the capture of one in Cameron or Potter County within 16 years.

I have received no information of authentic records of the recent capture of this species in the State.

47. Felis concolor L. Puma, Panther.

Once found in all portions of the Commonwealth, the Panther now is restricted to the most inaccessible mountain districts. The numerous wild cat and "catamount" stories which find their way into the newspapers, describing the capture of so-called Panthers in the Allegheny Mountains, have justly made the more conservative class skeptical of their existence in the State. Careful inquiry, however, shows that not only are there well authenticated instances of their capture within the last ten years, but that a few may remain in the wilderness of Clearfield and its surrounding counties, as well as in the northeastern section of the State.

Sullivan County:—"My father killed the last one in this region certainly known to me, between the years 1855 and 1860"—Bennett.

Clinton and Clearfield Counties:—"There may be one or two yet in Clearfield County; but the Askey boys and I killed 2, two years ago [1891]"—Nelson. In a later letter Mr. Nelson writes: "Those panthers skins, with two others, went to Germany with a lot of other furs, by Schrader & Co. I did not kill the panther, it got in my

49. Parascalops breweri (Bachm.). Brewer's Mole.

A specimen of the hairy-tailed mole is recorded from Hollidaysburg, Blair County, by Mr. F. W. True, in his "Revision of the American Moles." It is in the Museum of Comparative Zoology, Cambridge, Mass.

I have never seen a Pennsylvania specimen, nor know of other records from the State.

50. Condylura cristata (L.). Star-nose Mole.

Though no specimens of this mole have been noted by me in central Pennsylvania there is little doubt of its comparative abundance over the entire area. Prof. Baird records a specimen from Carlisle.

51. Blarina brevicauda (Say). Northern Mole Shrew.

In the Allegheny Mountains this species is quite typical of the northern form. It is everywhere very abundant.

52. Blarina cinerea Say. Least Mole Shrew.

I include this species here on the authority of Prof. Baird, who records one from Carlisle. The only Pennsylvania specimen known to me is in my private collection. It was taken by my friend, Witmer Stone, near Thorndale, Chester County. This southern species is not likely to occur north of the foothills of the Blue Ridge.

53. Sorex personatus Is. Geoff. St. Hil. Masked Shrew.

This tiny mammal is sometimes taken by the professional mouser in both the deeper forests and the open grounds near woodland. It appears more numerous in the northern and mountain districts than in the southern lowlands. In the former places it associates with the next species, but is there the rarer of the two.

54. Sorex fumeus Miller. Smoky Shrew.

This larger of the long-tailed shrews is abundant in the mountain forests, to which it seems closely confined. It is characteristic of the Alleghenian as contrasted with the Carolinian fauna, whereas the masked shrew inhabits both.

I have specimens from Sullivan, Clinton, Cambria and Somerset Counties.

The rare Marsh Shrew, *Sorex albibarbis*, of which I took a specimen in Monroe County in 1894, will undoubtedly be found to be a denizen of the hemlock swamps of the central Alleghenies. So far, however, it has escaped notice in these localities.

55. Adelonycteris fusca (Pal. de Beauv.). Large Brown Bat.

Everywhere abundant, except on the heavier wooded mountain summits.

56. Vesperugo carolinensis (Is. Geoff. St. Hil.). Carolina Bat.

Rare in central Pennsylvania. Probably confined to the regions southeast of the Blue Ridge. Prof. Baird secured a specimen, now in the Smithsonian Institution, from Carlisle.

57. Lasionycteris noctivagans (LeC.). Silvery Bat.

Numerously distributed over the entire region.

58. Nycticejus humeralis O. Thos. Twilight Bat.

The only record of this southern species known to me is a specimen taken at Carlisle by Prof. Baird.

59. Atalapha borealis (Müll.). Red Bat.

An abundant species.

60. Atalapha cinerea (Pal. de Beauv.). Hoary Bat.

This large bat is little known to the mountaineers, so far as my inquiries have gone. I have never seen a specimen in life. One taken near Renovo, Clinton County, is in the collection of A. K. Pierce, of that borough. From its known range in the United States and Canada it is more likely to be found in middle than in eastern Pennsylvania,

[redacted]

Of Algonquin stock there were wandering Shawnee invasions of the mountain regions west of the Susquehanna in Pre-Columbian times. The Assiwikales of the sea-board in 1731 settled along the Susquehanna and in the watershed of the Monongahela. The Algonkian Nantichokes of Maryland also migrated up the Susquehanna during the middle of the 18th century, settling with the Iroquois at Juniata and Shamokin, and they probably built the mounds covering heaps of human bones near Sunbury, identified by Mr. H. C. Mercer. By the year 1800 they had left Pennsylvania and dwindled to five families living among the Iroquois of western New York.

Of the existing Indians which represent the ancient occupants or claimants of central Pennsylvania there were 98 Senecas and Onondagas living in 1890 on the Cornplanter Reservation in Warren County. There were also 255 Senecas in Indian Territory, 5,133 Iroquois in the seven reservations (Onondaga, Tonawanda, Cattaraugas, Allegheny, Oil Springs, Tuscarora and St. Regis) in New York, in 1890. Beside these may be mentioned 1,200 Shawnees living in (?) 1867, and about 2,500 Cherokees in 1890, all living in Indian Territory.

A few of the more noted Indian villages noted by scouts, missionaries and settlers in central Pennsylvania include the following:—

Indian name.	*Modern name.*
Chinklaca-moose	Clearfield, Clearfield Co.
Kishaca-quillas	Mifflin Co.
Chillis-quaque (Shawnee)	Northumberland Co.
Shamokin	Shamokin, Northumberland Co.
Conosoragy (Shawnee, 1755)	Near Muncy Creek, Lycoming Co.
Otston-nakin	Montoursville, Lycoming Co.
Quenis-chas-chackki	Linden, Lycoming Co.
Wyoming	Wyoming, Luzerne Co.
Wyalusing	Wyalusing, Bradford Co.
Sesquehanock (Carantonans)	Spanish Hill, Bradford Co.
Oscolni	On Sugar Creek, Bradford Co.
Gohontoto	On Wyalusing Creek, Bradford Co.
Chingilo-molonk	Lock Haven, Clinton Co.

In an exploration of the Susquehanna Valley from Pittston to Harrisburg in 1892 Mr. Mercer writes me he "found ample evidence of former Indian villages along the main river at the mouths of all important streams, and similar proofs establish villages at the

mouth of Canadaguinnet Creek, Yellow Breeches Creek, on the Susquehanna, both left and right banks, near Bainbridge, Lancaster Co., at Caldwells Island, Great Island, and North Branch above Shamokin, along Conewago and Tuscarora Creeks, near Academia, on the Juniata and at the mouth of the Tuscarora. Probably the Shamokin site was the most important on the river in prehistoric times, the sites at Montoursville and mouth of Juniata ranking next."

A NEW SOUTHEASTERN RACE OF THE LITTLE BROWN BAT.

BY SAMUEL N. RHOADS.

In my "Contributions to the Mammalogy of Florida"[1] occurs the first, and, so far as I am aware, the only record of *Vespertilio lucifugus* (=" *V. gryphus* "?) from the extreme southeastern section of the United States. The series in question included six specimens in alcohol and two carefully prepared dry skins, with skulls and field measurements taken by the collector, Mr. W. S. Dickinson, from the animals before skinning. Their identification was made by Dr. Harrison Allen from the alcoholic specimens only.

Recently, in overhauling and labelling my collection, I made a more careful examination of this series. In consequence I find it necessary to separate the Florida form as a very distinct subspecies under the following name and diagnosis:

Vespertilio lucifugus austroriparius, Subsp. nov. Southeastern Little Brown Bat.

Type, No. 878, ad. ♀, Collection of S. N. Rhoads. Collected by W. S. Dickinson, June 23, 1892, at Tarpon Springs, Florida.

Description of type.—Smaller than *lucifugus* of N. Carolina and northward. Fur very short, fine and dense, about half as long as in New York specimens taken in the same season. Color above uniform, dull, dark brown, inclining to smoke-brown or dark chocolate as contrasted with the normal glossy, tawny and umber browns of northern specimens. Below brownish-cinereous, becoming lighter posteriorly and edged by a conspicuous margin of tawny white at the junction of wing membranes with lower half of body. Upper body fur slightly darker basally for $\frac{1}{2}$ to $\frac{2}{3}$ its length, the difference in shade between the brown-black of basal portion and the smoky-brown of terminal third of hairs only to be distinguished by close scrutiny. In *lucifugus* the contrast between these parts is conspicuous. On the lower parts this contrast is equally marked in both forms.

In the characters of the skull, save in the diminished size of *austroriparius,* I can detect no marked differences. The latter, how-

[1] Proc. Acad. Nat. Sci. Phila., 1894, p. 157.

ever, has a relatively shorter and wider skull with more abruptly depressed facial plane in the three specimens used in this comparison.

Measurements of type.—Total length, 83 millimeters; tail vertebræ, 32; hind foot, 7.5. Skull: total length, 14; zygomatic breadth, 8; length of mandible, 10.5.

Specimens in the series date from the last of June to the middle of September, some having been taken in August, showing that this is a resident Floridian form and in no sense a winter migrant from northern latitudes. Neither is it to be confounded with *V. albescens* of Is. Geoff. St. Hilaire, differing therefrom in respect to the shape of tragus and coloration of the lower jaw, precisely as does typical *lucifugus.*

Of the names already given to a possible southeastern form of *lucifugus*, I find none which can be referred to as possibly applicable to *austroriparius* except *V. subflavus* of F. Cuvier,[1] from Georgia. In Cuvier's description *subflavus* is said to have the tragus half heart-shaped, and the body colors are so light both above and below as to suggest a light colored *Vesperugo carolinensis.* Cuvier's *subflavus* is virtually unidentifiable, though Dr. Allen thinks it perhaps referable to "*gryphus.*"

[1] Nouv. Ann. du Mus. Hist. Nat., 1832, p. 15.

CONTRIBUTIONS TO A KNOWLEDGE OF THE HYMENOPTERA OF BRAZIL, NO. 2.—POMPILIDÆ.

BY WILLIAM J. FOX.

In this, the second paper based on the collections of Mr. Herbert H. Smith made in Brazil, many species are described, presumably for the first time. Much difficulty has been encountered in determining the Pompilidæ in question because the writer has been obliged to rely entirely on descriptions, which in many instances are faulty and meager. The difficulty has been heightened by the diversity of classification of the older writers on the subject.

Ceropales abdominalis Tasch.

Corumbá (April, May). Three female and one male specimen.

Ceropales sp.

A male from Corumbá (April) is close to *abdominalis*, but the antennæ are fulvous beneath, the apex of dorsal segments 2–6 and seventh entirely are yellow, and punctuation of head and thorax is coarser.

Notocyphus saevissimus Sm.

Corumbá (April, May); Santarem (September).

Notocyphus tyrannicus Sm.

Chapada (March). Six specimens, varying from 19–28 mm. The larger specimens lack the purplish and bluish pile mentioned by Smith.

Notocyphus brevicornis n. sp.

♀.—Black, subopaque; palpi testaceous; head indistinctly punctured; space between eyes at top about equal to length of the second, third and half of the fourth antennal joints; hind ocelli separated by a distance at least equal to that between them and nearest eye-margin; the front is broader than in *tyrannicus;* clypeus broadly truncate, not twice as broad as long; labrum nearly as long as the clypeus is broad, narrowed anteriorly and emarginate; eyes well separated from base of mandibles; antennæ stout, short, not longer than head and thorax united, the first joint of flagellum longer than the second;

pronotum rounded antero-laterally, posteriorly arcuate, in the middle about as long as the scutellum; seen from the side, the dorsulum is much flatter than in *tyrannicus* and the middle segment is shorter, the posterior surface not being emarginate but depressed or subconcave, the postero-lateral angles hardly prominent; the upper surface with a faint central, longitudinal furrow; legs feebly spinose, the inner spur of hind tibiæ just about half as long as the first hind tarsal joint; wings comparatively shorter than in *tyrannicus*, blackish with a reddish-purple iridescence, second submarginal rhomboidal; abdomen compressed apically. Length 15–17 mm.

Chapada (March, October). Two specimens. Has a superficial resemblence to species of the genus *Notogonia*.

Notocyphus abnormis Tasch. (=*Ceropales abnormis* Tasch.).

Six specimens, Chapada (March, September, November). They vary from 13–17 mm. in length.

Notocyphus terminatus n. sp.

♀.—Black; palpi testaceous; seven last antennal joints orange; eyes not reaching mandibles; clypeus broadly truncate; labrum narrowed apically, truncate, in length scarcely equal to width of clypeus; space between eyes above about equal to length of second and third antennal joints; antennæ stout, somewhat longer than head and thorax; pronotum posteriorly arcuate, having a tendency to become angular; middle segment long, strongly emarginate and concave posteriorly, the postero-lateral angles produced and strongly [redacted]

Notocyphus dubius n. sp.

♀.—Black; spot on each side of dorsal abdominal segments 1–5 varying in size and sometimes uniting on 2 and 3, sixth segment entirely, pale reddish; inner and posterior orbits narrowly and obscurely, clypeus at base and laterally and hind margin of pronotum yellowish; head and thorax with a silvery sericeous pile, more observable in certain lights; front strongly furrowed, convex on each side; eyes not reaching base of mandibles, space between them at top about equal to length of first joint of flagellum; hind ocelli separated by a somewhat greater distance than from the inner eye margin; clypeus broadly truncate, more than three times broader than long; labrum truncate, not as long as the clypeus is wide; antennæ longer than head and thorax united; pronotum strongly arcuate posteriorly; middle segment long, emarginate posteriorly, the postero-lateral angles produced, upper surface with a longitudinal, central impressed line, from each stigma a deep furrow runs to hind coxæ; legs feebly spinose, the longer spur of hind tibiæ a little more than half as long as the first hind tarsal joint; wings yellowish, apical margins fuscous, cubital vein of hind wings interstitial with apex of submedian cell; abdomen about as long as the thorax, compressed apically, with a faint bluish pile. Length 21–22 mm.

Santarem (February). Two specimens. Seems to be near *maculifrons* Smith and *macrostoma* Kohl. From the former it differs in coloration of wings, antennæ and abdomen. It is, perhaps, closer to *macrostoma*, but is larger, and, judging from Kohl's figure, the middle segment is differently shaped.

Notocyphus similis n. sp.

♀.—Black; wings yellow, apical margins slightly fuscous; clypeus short, broadly truncate, more than three times broader than long; labrum nearly as broad as long, shorter than width of clypeus, broadly emarginate at apex; front with impressed line; eyes but little separated from mandibles, space between them at top about equal to length of first joint of flagellum; hind ocelli separated by a greater distance than they are from nearest eye-margin; antennæ longer than head and thorax; pronotum arcuate posteriorly; middle segment roundly emarginate posteriorly, but not strongly, the postero-lateral angles scarcely prominent, when viewed from within; posterior face with a fine transverse striation, the stigmal furrow shallow above; tibiæ not at all spinose, the longer spur of hind pair

a little more than half as long as the first hind tarsal joint; cubital vein of hind wings interstitial with apex of submedian cell; abdomen as long as thorax, compressed apically, with a faint, bluish tinge. Length 18 mm.

Santarem. One specimen. Allied apparently, to *melanosoma* Kohl, but differs in the longer pronotum which, in the middle, is fully half as long as the longest part of dorsulum. The front is longer and narrower than in *melanosoma*.

Notocyphus ferrugineus n. sp.

♀.—Ferruginous; sutures of thorax, and apex of dorsal abdominal segments obscurely, black; clypeus subtruncate, or slightly rounded-out; labrum about as long as it is broad at base, subtruncate at apex; front with impressed line, which becomes obsolete, however, toward base of antennæ; the latter broken off and missing beyond the first three joints; eyes but little separated from the mandibles, the space between them at the top about equal to the length of first joint of flagellum; hind ocelli separated by a much greater distance than from the nearest eye-margin; pronotum arcuate posteriorly; middle segment not emarginate, posterior surface depressed, or concave, postero-lateral angles not at all produced, upper surface shorter than the dorsulum, parted by a longitudinal, central, impressed line; legs feebly spinose, the longer spur of hind tibiæ at the most half as long as the first hind tarsal joint; wings fulvo-hyaline, the costal half of the superiors fuscous, the apical mar-

[redacted]

thorax; pronotum rather shorter, evenly rounded antero-laterally, posteriorly subangulate; middle segment entire, the upper and posterior surfaces scarcely separated, postero-lateral angles rounded, the posterior portion slightly depressed, indistinctly striated transversely, stigmal furrow represented by a pit over the hind coxæ; legs feebly spinose, longer spur of hind tibiæ about two-thirds as long as first hind tarsal joint; wings subhyaline, darker apically, including most of marginal, apex of second submarginal and third entirely, first recurrent vein received by second submarginal before middle, cubital vein of hind wings interstitial with apex of submedian cell; abdomen as long as head and thorax, scarcely compressed. Length 14–15 mm.

Santarem. Two specimens.

Notocyphus obscuripennis n. sp.

♀.—Black; palpi yellowish; second dorsal abdominal segment with a transverse reddish-yellow fascia, which is almost interrupted medially; head and thorax with grayish-sericeous pile, densest on clypeus; clypeus somewhat more than twice broader than long, its fore margin very slightly incurved; labrum a little longer than broad at base, emarginate, with the clypeus finely though distinctly punctured; front finely punctured, impressed line faint: eyes well separated from base of mandibles, separated at the top by a distance greater than the length of the first joint of flagellum; distance between hind ocelli greater than that between them and nearest eye-margin; antennæ (last seven joints missing); pronotum subangular posteriorly; middle segment entire, posterior portion depressed slightly, postero-lateral angles rounded, not prominent, stigmal furrow shallow; legs feebly spinose, the longer spur of hind tibiæ nearly two-thirds as long as the first hind tarsal joint; wings fuscous, with a reddish-purple iridescence, recurrent vein received by second submarginal cell before the middle, cubital vein of hind wings interstitial with apex of submedian cell; abdomen barely as long as head and thorax, but little compressed. Length 12 mm.

Chapada (January). One specimen. The red band of abdomen gives the insect a superficial resemblance to *Pompilus marginatus* Say.

Notocyphus crassicornis Smith.

♂.—Black; including basal half of mandibles; clypeus, labrum, face, inner and posterior orbits broadly, scape and pedicellum be-

neath, prothorax on sides and above, except a lateral spot, broad central and narrow lateral stripes on dorsulum, greater portion of mesopleuræ, scutellum and postscutellum, middle segment except sides at base, large spot on coxæ, small one of fore trochanters, apex of fore femora and their tibiæ and tarsi entirely, first dorsal segment except apex, second at base, two transverse basal spots on third, spot on sixth and seventh and a spot on each side of second and third ventrals, bright yellow; joints 1–5, or 6 of flagellum fulvous beneath; apex of mandibles testaceous; clypeus about twice as broad as long; labrum about as long as clypeus is broad, incurved at apex; antennæ thick, about as long as head and thorax; eyes almost reaching base of mandibles; front distinctly impressed; middle segment entire, rounded behind; legs feebly spinose, the longer spur of hind tibiæ somewhat more than half as long as first hind tarsal joint; wings pale yellow, fuscous from apex of second submarginal cell, subhyaline at apex, recurrent vein received by second submarginal cell slightly beyond middle, cubital vein of hind wings originating far before apex of submedian cell; abdomen shorter than thorax, scarcely compressed. Length 12–13 mm.

Chapada (March). Two specimens. This is the *Ceropales crassicornis* Smith (Ann. Mag. N. H. (8) xii, 1873).

The following table will aid in separating the Brazilian species of *Notocyphus* contained in the present collection.[1]

Antennæ entirely black, ... 6.

6\. Antennæ distinctly longer than head and thorax united, ... ♀ *tyrannicus* Sm.

Antennæ at the most about equal to the combined length of head and thorax, ... ♀ *brevicornis* n. sp.

7\. Apical margin only of wings dark, ... 8.

Almost the outer half of wings blackish, their extreme tips pale (last seven joints of antennæ orange) . . ♀ *pictipennis* n. sp.

8\. Pronotum unusually short; antennæ thick, ... ♀ *melanosoma* Kohl.

Pronotum not unusually short, its length in the middle nearly equalling one-half the anterior width; antennæ slender, distinctly longer than head and thorax, ... ♀ *similis* n. sp.

9\. Middle segment emarginate posteriorly (maculation of abdomen reddish or reddish-yellow), ... 10.

Middle segment rounded or truncate posteriorly, ... 12.

10\. Head and pronotum not maculated, ... 11.

Inner and posterior orbits, sides of clypeus and line on pronotum yellowish, ... ♀ *macrostoma* Kohl, ♀ *dubius* n. sp.

11\. Abdomen maculated with red, ... ♀ *saevissimus* Sm.

Abdomen maculated with white, ... ♀ *rixosus* Sm.

12\. Head immaculate, ... 13.

Head maculated, ... 14.

13\. Wings subhyaline, a fuscous cloud including marginal except base, second submarginal and beyond; greater part of dorsal surface of abdomen reddish, ... ♀ *nubilipennis* n. sp.

Wings fuscous, with purplish iridescence; second dorsal segment with a transverse reddish band, ... *obscuripennis* n. sp.

14\. Head, thorax and abdomen richly maculated with yellow; wings yellow, apical third fuscous; basal antennal joints orange, ... ♂ *crassicornis* Sm.

Head and thorax black, the inner orbits, clypeus at sides and spot above insertion of antennæ, yellow; wings fusco-hyaline, with apex of anteriors dark fuscous, apical antennal joints fulvous beneath; abdomen maculated with ferruginous, ... ♀ *maculifrons* Sm.

Pseudagenia amabilis Tasch.

Agenia amabilis Taschenberg, Zeits. f. d. ges. Naturw., XXXIV, 45.

One specimen from Rio de Janeiro (November).

Pseudagenia femorata Sm. (=*Agenia femorata* Sm. non Fabr.).

Santarem. Six specimens without date of capture.

Pseudagenia comparata Sm.

Santarem (February and November). Ten specimens.

Agenia viridis Sm.[1]

One specimen. Santarem.

Agenia annulata Sm.

Chapada (September). One specimen.

Agenia tarsata Sm.

A specimen collected in April (no locality) is perhaps this species.

Agenia polistiformis Sm.

Santarem. One specimen.

Agenia pallida Tasch.

Chapada (November). The one specimen before me agrees fairly well with Taschenberg's description, except that it is not unusually pale, a character on which Taschenberg lays stress.

Agenia femorata Fabr.

Pompilus femoratus Fabricius, Syst. Piez., 190.

Mararú (April); Santarem. Five specimens.

Agenia micans Fabr.

Chapada (April). One specimen. Judging from the description,

punctato-rugose, feebly impressed down the middle; wings with a slight yellowish tinge, nervures testaceous, second and third submarginals at the top of about equal length, second recurrent vein slightly bowed; apical margins of abdominal segments narrowly and obscurely testaceous; pubescence of body golden and not dense. Length 9 mm.

Rio de Janeiro (July). One specimen. Allied to *Cressoni* and *curvinervis* Cam., and *auripilis* Cress. It lacks the rough front of the latter species.

Agenia rugosa n. sp.

♀.—Head and thorax, including coxæ and trochanters and base of femora blue; abdomen black, apical margins of the segments, narrowly testaceous; medial and hind tibiæ and tarsi fuscous, the femora except base and the fore tibiæ reddish; antennæ beneath and tegulæ testaceous; body pubescence cinereous; clypeus longest medially, but not angularly produced, convex; front microscopically punctured; pronotum slightly angulate posteriorly; middle segment rugoso-punctate, strongly impressed down the middle; wings clear, nervures black, third submarginal at the top longer than the corresponding portion of the second, second recurrent vein slightly sinuous. Length 9 mm.

Rio de Janeiro (November). One specimen.

Agenia chapadæ n. sp.

♀.—Dark metallic blue, abdomen darkest; antennæ, coxæ, trochanters, base of fore femora, apex of fore tarsi, the four hind tarsi and apex of hind tibiæ black; otherwise the legs are reddish; anterior margin of clypeus in the middle formed into a tooth; pronotum angulate posteriorly, swollen and prominent at sides; middle segment with a very faint trace of transverse striæ, scarcely impressed down the middle; calcaria testaceous; abdomen compressed apically; wings fuscous, paler at apex, with a purplish reflection, third submarginal at the top a little longer than the corresponding part of the second, second recurrent vein gently bowed; face and clypeus with dense cinereous pile. Length 8 mm.

Chapada (May).

Agenia costalis n. sp.

♀.—Metallic-green, with a tendency to blue on middle segment; antennæ paler beneath, tegulæ, apex of femora, tibiæ and tarsi, obscure testaceous, the fore tarsi basally, and the apical joints of max-

illary palpi pale; body pubescence cinereous, especially dense on face and clypeus; anterior margin of the latter rounded, pronotum subangulate posteriorly; middle segment finely granulated, slightly impressed down the middle; wings with costal margin broadly fuscous, otherwise subhyaline, nervures testaceous, second submarginal narrower than usual, its length at top fully one-third less than the corresponding part of the third submarginal; first abdominal segment rather long, distinctly longer than the second, petiolate. Length 8 mm.

Santarem. One specimen. The green color also extends on the coxæ, trochanters and part of femora.

Agenia albimacula n. sp.

♀.—Black, shining, rather densely covered with cinereous pile, especially on middle segment and abdomen; spot in middle of inner orbits, at base of antennæ, at apex of scape above anterior margin of clypeus, and joints 4–8 of flagellum above whitish; a line completely enclosing the pronotum, tegulæ, spot on dorsulum posteriorly, spot on scutellum, legs, and apex of dorsal abdominal segments 2–4 obscurely in the middle, fulvous; tarsal joints ringed with dark at apex; clypeus broadly subtruncate, a smooth shining depression before anterior ocellus; first and second joints of flagellum about equal in length; pronotum angular posteriorly; middle segment appar-

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wings subhyaline, the anteriors crossed by three fuscous fasciæ; the first crosses at the basal vein, the second fills base of marginal, second submarginal, base of third and apex of third discoidal, the third fascia at the apex, third submarginal at top about one-quarter greater than the corresponding portion of second, nervures testaceous, stigma black; abdomen shining, clavate, compressed, the first segment about as long as the two following united; body pubescence cinereous and sparse. Length 7 mm.

Chapada (October).

Agenia fragilis n. sp.

♂.—Black, with cinereous pubescence; clypeus at sides and anteriorly, sides of face, mandibles except base and the palpi, whitish; scape beneath, tegulæ, four anterior trochanters, the femora, anterior tibiæ and tarsi, medial tibiæ in part, first abdominal segment on sides and beneath, and second at base, reddish; calcaria and last dorsal segment white; pronotum angulate posteriorly; middle segment apparently smooth above, at base in the middle with a shining fovea from which a short impressed line emanates; legs slightly spinose; wings subhyaline, bifasciate with fuscous, the first fascia includes the base of marginal, second submarginal and apex of third discoidal, the second fills the wing beyond the third submarginal, third submarginal cell at top about one-third greater than the corresponding part of the second; abdomen clavate, compressed. Length 9 mm.

Marurú (April); Santarem. Three specimens.

Agenia cingulata n. sp.

♂.—Black, with cinereous pubescence which is especially dense on face, clypeus, thorax on sides and beneath, scape beneath, labrum, mandibles except apex, whitish; tegulæ and palpi testaceous; anterior and medial femora at apex, hind femora, four anterior tibiæ and sides of first abdominal segment, reddish; calcaria, anterior and medial tarsi whitish, the latter ringed with black at apex of joints; pronotum angulate posteriorly; middle segment evidently smooth, not impressed, legs feebly spinose; wings clear, fuscous at apex, nervures and stigma black, third submarginal at top a little greater than the corresponding portion of the second; abdomen clavate, compressed, the first segment as long as the two following united. Length 7 mm.

Chapada (September).

Agenia basalis n. sp.

♂.—Head and thorax metallic-green, including coxæ; antennæ above, trochanters, four hind tibiæ and tarsi and abdomen except base and apex, fuscous; face, clypeus except medially, mandibles, palpi, fore coxæ beneath, calcaria and last dorsal abdominal segment, whitish; antennæ beneath testaceous; all femora and anterior tibiæ and tarsi yellowish; first abdominal segment ringed with whitish, pronotum subangulate posteriorly; middle segment microscopically granulated, not impressed; hind tibiæ not spinose; abdomen scarcely compressed, first segment but little longer than second; wings clear, scarcely darker apically, nervures dark testaceous, third submarginal at top nearly one-quarter greater than the corresponding portion of second; second recurrent vein sinuous; body rather densely covered with silvery pubescence. Length 6 mm.

Santarem.

Agenia testacea n. sp.

♂.—Greater part of head and thorax blue-green; face, clypeus, mandibles and palpi pale yellow; first three antennal joints (remainder missing), prothorax except central spot above, tegulæ, pectus, legs entirely and abdomen testaceous-yellow, the abdominal segments except the first more or less obscure medially; pronotum angulate posteriorly; middle segment not impressed, legs not spin-[redacted]

3. Wings at the most with the tips fuscous; middle segment more or less rugose, ... 4.
   Wings fasciate, the fascia including second submarginal and apex of third discoidal cells, tips also fuscous; joints 4–8 of flagellum white; legs fulvous; pronotum maculated with yellow, ... *albimacula.*
4. Head and thorax blue-green; body pubescence cinereus; anterior tibiæ and femora except base red; wings clear, nervures black, ... *rugosa.*
   Head and thorax coppery-green; body pubescence golden; legs, (except coxæ), trochanters, base of femora, hind tibiæ apically and apex of tarsi red; wing with a slight yellowish tinge, nervures testaceous, ... *producta.*

MALES.

1. Wings fasciate, ... 2.
   Wings not fasciate, at most with tips fuscous, ... 3.
2. Wings trifasciate; black, with exception of the scape, pedicellum, fore tibiæ and tarsi, which are reddish; anterior margin of clypeus and sides of face narrowly whitish; tibial spurs testaceous, ... *trifasciata.*
   Wings bifasciate, fuscous; fore legs except coxæ, the medial femora and tibiæ, hind femora, first segment at sides and second at base reddish; sides of face and clypeus, tibial spurs and last segment whitish, ... *fragilis.*
3. Greater part of abdomen dark, the base pale, ... 4.
   Abdomen reddish-testaceous, the apical segments more or less obscure; prothorax, pectus and legs except apical tarsal joints yellowish-testaceous; thorax blue above; clypeus and face yellow; first three antennal joints yellowish-testaceous, (remaining joints wanting), ... *testacea.*
4. Black, with cinereous pubescence; calcaria white; medial tarsi white, ringed with black at apex of joints, ... *cingulata.*
   Head and thorax greenish; sides of face whitish; four hind tibiæ and tarsi black, ... *basalis.*

DIPOGON n. gen.

Allied to *Agenia*. Head rather flat, broader than thorax; eyes scarcely separated from base of mandibles, inner margins almost parallel; ocelli distinct, forming a triangle; antennæ rather short, shorter than in any species of *Agenia* known to me, but not thick;

mandibles 4-dentate at apex; maxillæ at base *with two long curved and diverging brushes of pale hairs;* maxillary palpi prominent, 6-jointed; labial palpi small, 4-jointed; thorax oblong, comparatively longer than in *Agenia*; legs rather stout, tibial spurs 1–2–2; to the apex the claws are suddenly narrowed from their middle, which point internally is formed into a small tooth; legs not spinose, *the hind tibiæ slightly serrated;* abdomen short and stout, the first segment campulate, with a short petiole; second ventral distinctly impressed transversely; wings ample (see pl. IV, fig. 1), stigma large; cubital vein of hind wing originating far beyond apex of submedian cell. Type *D. populator* n. sp.

Dipogon populator n. sp. Pl. IV, f. 1.

♀.—Black, more or less covered with grayish pile, especially on vertex, dorsulum and scutellum; antennæ, mandibles, palpi and tarsi reddish-testaceous; clypeus transverse, short, its fore margin broadly subtruncate, front not impressed; space between hind ocelli somewhat greater than that between them and nearest eye margin, the space between eyes above greater than the combined length of antennal joints 2 and 3; antennæ scarcely as long as head and thorax, first joint of flagellum more than one-quarter longer than second; pronotum slightly bowed posteriorly, middle segment entire, finely punctured, more or less rounded posteriorly; wings clear, with a fuscous fascia crossing the anteriors at the basal vein, and a fuscous cloud which fills the lower half of marginal, first submargi-

[redacted]

hairs; face and clypeus with cinereous pile, the clypeus incurved medially; front shining, obscurely punctured; space between eyes at top less than length of first joint of flagellum; space between hind ocelli about equal to that between them and the eyes, the latter distinctly converging above; antennæ slender, acuminate, the first joint of flagellum nearly one-third longer than the second; pronotum angulate behind; middle segment rounded, with a faint impressed line down middle; legs exceedingly spinose, calcaria long, reddish; the inner spur of hind tibiæ nearly two-thirds as long as the first hind tarsal joint, fore tarsal comb poorly developed in consequence of its spines being widely separated; claws with a sharp medial tooth; abdomen elongate-ovate; wings fuscous, with purple reflections, hind pair paler, third submarginal larger than second, at top nearly three times greater than corresponding portion of second basal vein, and cubital vein of hind wings interstitial; head with rather prominent long hairs, the thorax with them sparser. Length 15.

Rio de Janeiro (November). A specimen from same locality (July), measures 13 mm. is blacker, and the second and third submarginal cells differently shaped (see fig. 3). A variety or dimorphic form, perhaps.

This species evidently belongs to Kohl's Group 1.

Pompilus mundulus n. sp.

♀.—Steel blue; antennæ and tarsi black, with cinereous pile, especially dense on clypeus, coxæ beneath and middle segment; head broader than thorax, with sparse, long, black hairs; eyes reaching mandibles, not converging, space between them at the top less than the length of first flagellum joint, space between hind ocelli distinctly less than that between them and eyes: clypeus large, fore margin sub-rounded; front with impressed line; antennæ fairly slender, the first joint of flagellum more than one-third longer than second; pronotum angulate posteriorly; middle segment rounded, not impressed; legs fairly spinose, inner spur of hind tibiæ more than half but less than two-thirds as long as first hind tarsal joint, tarsal comb wanting; claws with a sharp medial tooth; abdomen ovate, about as long as thorax, last segment with long, stiff hairs; wings fuscous, with reddish-purple reflection, second submarginal nearly quadrate, but little narrowed above, third submarginal narrowed more than one-half at top, its width at this point about one-

half that of the corresponding part of second; basal and cubital (of hind wings) interstitial. Length 10½ mm.

Chapada (December). One specimen. Belongs to Kohl's Group 1.

Pompilus triquetrus n. sp.

♀.—Black; abdomen at base, and dorsals 1–3, or 4, more or less red (either with red fasciæ or entirely of that color); head and thorax maculated with bright silvery pubescence as follows: front, face, clypeus, cheeks, prothorax anteriorly and a medially interrupted line on posterior margin, dorsulum posteriorly, postscutellum (metanotum), large spot on mesopleuræ, small spot at each side of middle segment anteriorly and larger one at postero-lateral angles, and greater part of coxæ; clypeus incurved medially; eyes not converging, reaching mandibles, space between them at top about equalling the length of first flagellum joint; space between hind ocelli about equal to that separating them from eyes; front strongly impressed before the anterior ocellus; antennæ rather stout, about equal to length of head and thorax, the first flagellum joint as long as second and a little more than half of third united; pronotum angulate posteriorly; middle segment rounded, scarcely or not impressed; legs strongly spinose, tarsal comb fairly well developed; claws with a sharp median tooth, spurs testaceous, the inner one of hind tibiæ about equal to half the length of first hind tarsal joint (in two smaller specimens it is decidedly shorter); abdomen large, broad at base as in *amethystinus*, with cinereous pile, beneath and apically

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reaching mandibles, not converging, the space between them at top not equal to length of first flagellum joint; space between hind ocelli equalling that between them and eyes; front with faint impressed line, and with the vertex distinctly striato-punctate; first joint of flagellum nearly one-third longer than the second; pronotum subangulate behind; middle segment rounded, not impressed, the posterior portion slightly depressed; legs rather strongly spinose, tarsal comb fairly well developed, claws with a sharp median tooth, spurs reddish; the inner one of hind tibiæ fully two-thirds as long as the first hind tarsal joint; abdomen with cinereous pile, apical segments with sparse long hairs; wings dark fuscous with bluish-purple reflection, second submarginal twice the width of third at top. Length 16 mm.

Chapada (March). One specimen.

Pompilus deceptus n. sp. Pl. IV, f. 5.

♀.—Similar to *partitus* as to coloration; anterior margin of clypeus incurved; front smooth or finely punctured, not striate; space between hind ocelli less than that separating them from eyes, space between eyes at top equal to length of first flagellum joint; legs as in *partitus*, but the inner spur of hind tibiæ equalling but little more than half the length of first hind tarsal joint; wings as in *partitus*, except that the third submarginal is narrower at top, equalling less than one-half the corresponding portion of second. Length 14–17 mm.

♂.—Colored like ♀, the thorax with faint purplish reflection; face with pale pubescence; eyes not reaching base of mandibles; antennæ stout, longer than head and thorax, joints of flagellum rounded out beneath, its first and second joints nearly equal in length, the first perhaps longer; legs strongly spinose, longer spur of hind tibiæ four-fifths the length of first hind tarsal joint, claws bifid, the inner process the shorter and truncate; second submarginal cell larger than third, which is much narrowed above, the marginal cell rather short and broad; abdomen depressed. Length 12–13 mm.

Chapada (February, April, September). Five specimens. Has a superficial resemblance to *partitus*, but is distinguished by smooth front, etc.

Pompilus angusticeps n. sp.

♂.—Head, thorax and legs black; abdominal segments 1–3 reddish, the remainder black; face, scape beneath, sides of thorax

sparsely and abdomen with cinereous pile, especially prominent on dorsal segments 4 and 5; thorax with slight purplish reflection; head longer than broad: clypeus large, hardly twice as broad as it is long in the middle, front depressed before anterior ocellus, finely punctured; space between hind ocelli distinctly less than that between them and eyes; eyes distinctly separated from base of mandibles, separated above by a distance about equal to the fifth and sixth antennal joints; joints 1 and 2 of flagellum about equal in length; pronotum angulate behind; middle segment rounded behind, not impressed; legs strongly spinose, claws bifid, spurs large, the inner one of hind tibiæ nearly equal to four-fifths the length of first hind tarsal joint; abdomen depressed; wings fuscous, darker apically and basally with bluish reflection, width of third submarginal at top less than half that of second at same place. Length 13 mm.

Chapada (March). One specimen. Resembles male of *deceptus*, but may be distinguished by cinereous band of dorsal segments 4 and 5, elongate head, etc. The antennæ are also much shorter. This may prove to be the male of either *partitus* or *argenteus*.

Pompilus argenteus Tasch.

Chapada (December). One specimen. The females of *partitus* and *deceptus* are very similar, superficially, to *argenteus*. The medially denticulate clypeus and silvery sides of thorax of the latter distinguish it from them, however.

Pompilus pygidialis Kohl.

apical portion, its anterior margin slightly incurved in the middle; eyes almost reaching mandibles, converging above, the space between them at that point less than the length of first flagellum joint, but greater than the second; space between hind ocelli about equal or slightly less than that between them and eyes; first flagellum joint nearly one-third longer than second; pronotum angulate behind; middle segment rounded, not impressed; legs tolerably spinose, anterior tarsal comb short, composed of well-separated spines, claws with a rather blunt tooth in the middle, longer spur of hind tibiæ equal to about two-thirds the length of first hind tarsal joint, in smaller specimens somewhat less; abdomen with cinereous pile, with a few, black hairs at apex and beneath; wings having the costal half of superiors fuscous, otherwise subhyaline (a hyaline streak in the median cell), nervures black; marginal rather short and narrow, second submarginal somewhat wider than third. Length 10–15 mm.

Chapada (February, April). Six specimens.

These specimens are subject to variation: The yellow maculation is restricted or extended, the thorax being almost destitute of yellow in some, while in others that color is decidedly evident. The hind margin of pronotum, two stripes on dorsulum, spots on middle segment are yellow in one example, while another has the anterior portion of clypeus, wine-colored. The front has peculiar sculpture, which is difficult to describe, but which may be said to consist of elongate punctures, coalescing and forming irregular, wavy striæ.

Pompilus exquisitus n. sp.

♀.—Head and thorax black, including coxæ, trochanters and base of femora; abdomen, legs and antennæ, wine-color; clypeus (except base), labrum, mandibles, inner and posterior orbits, face, stripe extending from between antennæ up to center of front, hind margin of pronotum, two stripes on dorsulum, spot on each side of scutellum, the postscutellum, apex of middle segment and two dots before it, dot on metapleuræ, an interrupted oblique stripe on mesopleuræ, coxæ more or less, base of abdominal segments, particularly the first and second dorsals, the others obscurely, yellow; clypeus with some large punctures apically, its fore margin slightly incurved in the middle; front very finely punctured, not impressed; eyes almost reaching mandibles, converging above, the space between them at that point greater than length of first flagellum joint; space between hind ocelli a little less than that between them and eyes; antennæ rather short, the first flagellum joint nearly twice as long

as second ; pronotum subangulate behind ; middle segment rounded, not impressed ; legs rather strongly spinose, claws with a rather long central tooth giving them the appearance of being bifid, calcaria and tarsi at base yellowish, longer spur of hind tibiæ not equalling two-thirds the length of first hind tarsal joint ; abdomen not pilose, microscopically punctured, beneath and at apex with sparse hairs ; wings yellowish, dusky at tips, the venation practically the same as in *vinicolor*. Length 10–11 mm.

Chapada (March, December). Two specimens.

Pompilus familiaris Sm.

Twelve specimens. Uacarizal (February) ; Chapada (April, May) ; Corumbá (April).

Pompilus argenteomaculatus n. sp. Pl. IV, f. 7.

♀.—Black, with sericeous pile, especially on the abdomen which has a grayish appearance ; face, clypeus, cheeks, prothorax anteriorly and its posterior margin, short stripe on dorsulum near tegulæ, post-scutellum, greater part of middle segment, coxæ more or less, and spot on mesopleuræ beneath, silvery, pertaining to golden in some examples ; leg spines, calcaria and mandibles medially, reddish ; clypeus short, more than three times broader than long, fore margin incurved ; eyes reaching base of mandibles, separated above by a distance equal to less than length of first flagellum joint ; space between hind ocelli equal to or slightly less than that between them and eyes ; first joint of flagellum about one-third longer than second ;

Pompilus bilunulatus Sauss.

Rio de Janeiro (November). One male.

Pompilus exclusus Sm.

Santarem. One specimen.

Pompilus insignitus n. sp. Pl. IV, f. 8.

♂.—Black, with rather dense silken pile, which is silvery on face, sides of scutellum, postscutellum and middle segment posteriorly; hind margin of pronotum (which is arcuate), fascia at base of second dorsal segment, a spot at apex of fore femora, and short stripe on all tibiæ externally, yellowish; five or six basal antennal joints beneath fulvous; clypeus subtruncate, about twice as wide as long in the middle; eyes slightly separated from base of mandibles, at the top the distance between them is about equal to the combined length of the scape and following two antennal joints; space between hind ocelli somewhat less than that between them and eyes; antennæ short, barely as long as head and thorax, at any rate not longer, first and second joints of flagellum about equal in length; middle segment rounded behind; legs tolerably spinose, fore tarsi feebly so, claws bifid, longer spur of hind tibiæ almost equalling the first hind tarsal joint; abdomen with apical margin of segments, as well as legs, obscurely brownish; wings subhyaline, the anterior portion of superiors darker particularly from marginal cell to apex, third submarginal longer than second beneath, at the top, however, nearly one-half shorter. Length 9–10 mm.

Santarem. Five specimens.

Pompilus singularis n. sp. Pl. IV, f. 9, 10.

♂.—Bluish-purple, when held in certain lights changing to black; antennæ entirely black; head very transverse, nearly one-third broader than long; eyes very shortly ovate, scarcely separated from base of mandibles, diverging above, at which place they are separated by a distance about equal to the posterior width of pronotum; ocelli almost forming a curved line, the hind pair separated by a distance about equal to half that between them and eyes; front with distinct, even punctures, medially impressed; clypeus finely punctured at base, striato-punctate apically broadly truncate; labrum prominent; antennæ distinctly shorter than head and thorax, thick; pronotum angulate posteriorly; scutellum and postscutellum (metanotum) prominent and elevated, finely punctured, the postscutellum at sides coarsely obliquely striated; middle segment much lower than

metanotum, rather truncated, above basally obliquely striated, becoming granulate posteriorly, while the posterior surface has a spongy or porous appearance; legs scarcely spinose, claws bifid, the anteriors with the inner part short, (hind claws missing); abdomen elongate-ovate, with sparse, black hairs beneath, sixth ventral at apex with a strong medial emargination on each side of which is a strong tooth, seventh ventral slightly keeled down middle, its upper surface, which is visible from above, bounded by a prominent margin or reflexion; wings broad, dark bluish and purple. Length 18 mm.

Chapada (April). One specimen. This is a remarkable *Pompilus* in the shape of head, sculpture, elevated postscutellum and broad wings. It comes nearly to that group of species of which *pygidialis* Kohl and *fervidus* Smith, are types. The venation of wings: an unusually long marginal cell; basal vein originating before apex of submedian cell; cubital vein of hind wing originating far before apex of submedian cell.

Pompilus polistoides Sm.

Twenty-three specimens of both sexes. Chapada (March, April, November, December); Corumbá and Marurú (April); Rio de Janeiro (November); Santarem. This species varies considerably in size, but the maculation is fairly constant.

with strong purplish effulgence, second submarginal rhomboidal, third submarginal very large, receiving the second recurrent vein between base and middle, basal vein and cubital vein of hind wings interstitial. Length 12–14 mm.

♂.—Similar to female, but more slender, the abdomen almost petiolate; legs scarcely spinose, claws with a basal prominence the anterior pair bifid, longer spur of hind tibiæ nearly two-thirds as long as first hind tarsal joint; wings brighter (aniline red and blue). Length 9–12 mm.

Santarem (February); Marurú (April); Rio de Janeiro (November); Chapada (December). Twelve female, ten male specimens. Seems to be near *P. tristis* Kohl.

Pompilus nobilis Fabr.

Rio de Janeiro (July, November); Santarem; Chapada (April). *P. multifasciatus* Tasch., is probably identical with *nobilis*.

Pompilus sp.

A series of male specimens from Santarem, which are very close, in appearance, to *nobilis* ♀, but which probably belong to another species, perhaps new.

Pompilus sericeifrons n. sp.

♀.—Black, densely clothed with silvery pile, especially on the sides of thorax, the abdomen sparsely; antennæ, legs and upper surface of thorax as far as middle segment not silvery; clypeus with fore margin broadly subtruncate, smooth and shining, otherwise clothed with silky pile; front densely clothed with pale golden pile, impressed down the middle; eyes reaching mandibles, very slightly converging above, at which place they are separated by a distance greater than the combined length of scape and pedicellum, but much less than that of first flagellum joint; space between hind ocelli but little less than that which separates them from the eyes; antennæ rather long and slender, the first joint of flagellum nearly as long as the two following joints united; pronotum angulate behind, transversely swollen medially; middle segment indistinctly impressed, posteriorly with coarse transverse striæ; legs not very strongly spinose, no tarsal comb, tarsi testaceous, claws bifid, calcaria short, the longer spur of hind tibiæ about one-fourth the length of first hind tarsal joint; abdomen ovate, with sparse pale hairs at apex; wings subhyaline, the anteriors with two broad fuscous bands, one crossing the wing at apex of median cell, the other including

basal two-thirds of marginal, the second and third submarginal, and part of third discoidal cells, apex of anteriors narrowly, that of posteriors more broadly, faintly fuscous, marginal cell long and lanceolate, second submarginal rhomboidal, receiving first recurrent vein near apex, third submarginal large, narrowed more than one-half above, at which place it is slightly narrower than the corresponding portion of second, nervures dark testaceous. Length 17 mm.

Santarem (February). One specimen. Has a superficial resemblance to *nobilis* Fabr.

Pompilus manifestatus Sm. (=*Agenia manifestata* Sm.).

Santarem. The only specimen represented agrees with the description of *Agenia manifestata* Smith, but it is not an *Agenia*.

Pompilus scrupulus n. sp. Pl. IV, f. 12.

♀.—Black, clothed with silvery pile which is visible in certain lights; clypeus short, more than three times broader than long, its fore margin shining and broadly truncate; front smooth, opaque, not impressed; eyes reaching mandibles, converging above, at which point they are separated by a distance about equal to the length of the first flagellum joint; this latter not quite twice as long as the second joint; space between hind ocelli much less than that between them and eyes; pronotum angulate behind, transversely bi-tumid; middle segment smooth, rounded behind, with a longitudinal medial [redacted]

whitish-yellow; head and thorax with silvery-sericeous pile, most conspicuous on face, clypeus, thorax on sides and beneath and coxæ; clypeus rather small, its fore margin broadly truncate; front with a medial impressed line; eyes large, reaching base of mandibles, inner orbits almost parallel, separated above by a distance greater than the combined length of pedicellum and first flagellum joint; ocelli large, the space between hind pair about equal to that between them and eyes; antennæ long, much longer than head and thorax united, the first joint of flagellum a little longer than second; hind margin of pronotum subangulate; dorsulum convex; scutellum unusually high and prominent, finely and transversely striated on the sides; middle segment much below level of rest of thorax, convex, rounded behind, finely coriaceous and divided by a strong longitudinal impressed line, reaching about two-thirds its length; legs graceful, not strongly spinose, claws bifid, calcaria long, the longer of the hind pair not equalling two-thirds the length of first hind tarsal joint; abdomen subpetiolate, clavate compressed, first segment longer than second; wings subhyaline, the superiors crossed by two fuscous bands, the outer of which is the broader, nervures dark testaceous, second submarginal rhomboidal, not as large as third, which is narrowed about one-third to the marginal. Length 15 mm.

Santarem. One specimen.

Pompilus gracillimus Sm.

Chapada (May). One specimen.

Pompilus resplendens n. sp.

♂.—Front, cheeks, greater part of upper and lateral portions of thorax and abdomen black or blackish with a tinge of brown; antennæ, clypeus, mandibles, palpi, prothorax, legs including coxæ, and tegulæ, pale castaneous; hind margin of pronotum, spot at apex of middle segment, one on the anterior coxæ, calcaria of medial and hind legs, and base of dorsal abdominal segments 1–3, yellowish; entire insect, especially the front, clypeus and sides of thorax with golden pubescence; clypeus small, broadly subtruncate anteriorly; front; subopaque, with impressed line distinct; eyes large, reaching base of mandibles, the inner orbits, if anything slightly diverging above, at which point they are separated by a distance about equal to the combined length of flagellum joints 1 and 2; space between hind ocelli slightly greater than that between them and eyes; antennæ longer than head and thorax united, the first and second

joints of flagellum equal in length; pronotum rounded behind; scutellum prominent but not unusually so; middle segment rather flat, impressed for two-thirds its length, the posterior surface, which is but feebly defined, depressed; legs tolerably spinose, claws bifid, longer spur of hind tibiæ not equal to two-thirds length of first hind tarsal joint; abdomen subpetiolate, compressed, clavate, first segment longer than second; wings subhyaline, a fuscous cloud fills base of marginal, apex of second and third submarginal entirely, a trace of a fascia crosses the superiors at apex of median cell, second submarginal rhomboidal, much higher than broad, the third submarginal much the larger, narrowed somewhat more than half to the marginal. Length 12 mm.

Chapada (April). One specimen.

Pompilus serratus n. sp.

♂.—Black, with silvery-sericeous pile, especially on the thorax beneath; flagellum beneath fulvous; spot on scape beneath, on each side of clypeus, mandibles except apex, hind margin of pronotum obscurely, anterior coxæ in part, calcaria of four hind legs, base of second abdominal segment and spot on seventh dorsal segment, white; palpi, anterior tibiæ and tarsi, and tegulæ, testaceous; anterior margin of clypeus slightly incurved or subtruncate; front not impressed; eyes reaching mandibles, inner orbits sinuous, somewhat diverging above, the space between them at the vertex about equal

Pompilus fragilis Sm.

Chapada (December, April); Corumbá (April, May); Santarem (May). Eight specimens.

Pompilus ruficoxalis n. sp.

♂.—Head, thorax and legs black with purplish pile; abdomen bluish; four hind coxæ red; anterior margin of clypeus slightly incurved or rather subtruncate; front with impressed line; eyes separated from base of mandibles, inner margins parallel, separated above by a distance about equal to the third and half of the fourth antennal joints; space between hind ocelli less than half that separating them from eyes; antennæ slender, first joint of flagellum one-third longer than second; pronotum angulate behind; scutellum elevated, strongly compressed; middle segment, sloping from base to apex, with scarcely any convexity, parted for two-thirds its length by an impressed line; legs rather weakly spinose, claws of fore and medial tarsi bifid, the hind ones simple, longer spur of hind tibiæ equal to about half the length of first hind tarsal joint; abdomen compressed, subpetiolate, sixth ventral segment deeply and narrowly emarginate in middle of apical margin, subgenital plate elongato-acuminate, rather densely hirsute; wings dark fuscous, with purplish reflection, second submarginal cell rhomboidal, slightly higher than broad, third very large, narrowed less than one-half toward marginal. Length 12 mm.

Chapada (May). One specimen. The dark body and red medial and hind coxæ form a contrast in coloration which is apparently unique in the Pompilidæ.

Pompilus sulcatus n. sp. Pl. IV, f. 15.

♀.—Black; face, clypeus and thorax on sides and beneath with pale grayish pile, the pronotum anteriorly, and base dorsal abdominal segments 1–3, or 4, with plumbeus pile; flagellum beneath and tegulæ obscurely testaceous; head rather flat, the occiput somewhat sunken; front with punctures running into irregular striæ; clypeus with fore margin slightly incurved; eyes well separated from base of mandibles, the inner orbits converging from above their middle, separated above by a distance greater than the length of pedicellum and first flagellum joint united; space between hind ocelli more than one-third greater than that between them and eyes; antennæ about as long as head and thorax, the first joint of flagellum but little longer than the second; cheeks scarcely developed; pronotum evenly rounded and convex, angulate behind; middle segment sub-

rounded or subtruncate, divided longitudinally by a rather broad shallow furrow, which is indistinct on posterior surface; legs with with strong, though not plentiful, spines, claws bifid, no tarsal comb, longer spur of hind tibiæ equal to more than half length of first hind tarsal joint; abdomen with a slight purplish cast; wings fuscous, with purplish reflection, hind pair paler, marginal cell short, somewhat triangular, second submarginal subquadrate longer than high, third shortly petiolate. Length 10 mm.

Santarem. One example.

Pompilus varius Fabr.

Two (♂) specimens in the collection agree with Fabricius' brief diagnosis of this species. Chapada (December); Santarem.

Pompilus ornamentus n. sp. Pl. IV, f. 13.

♂.—Black, somewhat iridescent in places; head in front, pronotum anteriorly, posterior half of middle segment, pleuræ with spots, pectus, legs, more or less particularly coxæ and femora beneath ventral abdominal segments 1–3 and dorsals 1 and 2 laterally and basally, with silvery-white, sericeous pile, on segments 4–7 it is plumbeus; clypeus with fore margin slightly incurved; front impressed, especially before anterior ocellus; eyes separated from base of mandibles, converging from above their middle, the space between them above about as great as the combined length of antennal joints 3 and [redacted]

with dense silvery pubescence, head clothed with long pale hairs; clypeus truncate anteriorly; front and vertex with a peculiar wrinkle-like sculpturing; eyes well separated from base of mandibles, almost parallel within, separated above by a distance greater than the combined length of the pedicellum and joints 1 and 2 of flagellum; space between hind ocelli slightly greater than that between them and eyes; antennæ short, flagellum with joints irregular or swollen beneath, joints 1 and 2 about equal in length; pronotum subangulate (almost arcuate) behind; middle segment subtruncate, impressed down middle, legs with strong, though not dense, spines, claws bifid, longer spur of hind tibiæ slightly more than half as long as first hind tarsal joint; abdomen short, compressed, a yellow spot on last dorsal; wings subhyaline, iridescent, apical margin of anteriors broadly fuscous, second submarginal nearly quadrate, third smaller, shortly petiolate. Length 11 mm.

Corumbá (April). One specimen.

Pompilus personatus n. sp.

♂.—Colored like *annulipes*, except that the hind femora and the middle and hind tarsi are reddish, and the flagellum black; pubescence or pile of head and thorax bright silvery, that on front and thorax above somewhat golden; clypeus slightly incurved anteriorly; front and vertex smooth, at most with very fine punctures; eyes separated from base of mandibles but by a much less distance than in *annulipes*, separated above by a distance about equal to combined length of pedicellum and flagellum joints 1 and 2; space between hind ocelli slightly less than that between them and eyes; thorax and legs as in *annulipes*, but calcaria reddish; abdomen rather depressed, last dorsal segment with silvery pile; wings colored as in *annulipes*, with the apex of both wings dark, second submarginal cell almost oblong, larger than the third, which while greatly narrowed above, is not petiolate. Length 10–11 mm.

Corumbá (April); Santarem. Two specimens.

Pompilus conterminus Sm.

Chapada (March, April); Pedra Branca (April). Three specimens.

Pompilus fulgidifrons n. sp.

♀.—Black; first two abdominal segments red: face, clypeus, thorax beneath with silvery pile; tarsi obscurely reddish; clypeus finely and closely punctured, its fore margin gently incurved; front

shining, impressed down middle; eyes almost reaching base of mandibles, converging somewhat above, the space between them at that point about equal to the combined length of pedicellum and first flagellum joint; space between hind ocelli slightly less than that separating them from the eyes; antennæ fairly long, the first joint of flagellum not quite one-third longer than second; pronotum subangulate behind; middle segment rounded, not impressed; legs strongly, but not densely spinose, fore tarsi with comb, claws bifid, longer spur of hind tibiæ more than half as long as first hind tarsal joint; abdomen robust, ovate, ventral segments with large, sparse punctures from which long, black hairs project; wings fuscous, with violaceous reflection, second submarginal cell rhomboidal, its length and height nearly equal, the third longer, narrowed about four-fifths to the marginal. Length 15 mm.

Chapada (March). One example.

Pompilus caliginosus Fox (n. n. for *funereus* Tasch. non Lep.).

Chapada (March). One example. Lepeletier de Saint Fargeau used the name *funereus* for a Pompilus in 1845.

Pompilus auripennis Fabr.

One example. Santarem.

Pompilus rutilans n. sp.

♀.—Ferruginous; sutures of thorax more or less, and abdomen [redacted]

second submarginal subquadrate, third larger narrowed about one-half to marginal. Length 19 mm.

Chapada.

This species is remarkable in the bituberculate middle-segment.

Pompilus (Aporus) quadrimaculatus Sm.

Chapada (March). One example.

Pompilus (Aporus) minutus Sm.

Santarem. Three specimens.

The following table will aid in determining the new species of *Pompilus* preceding:

1. Females, ... 2.
   Males, ... 15.
2. Middle segment rounded, unarmed, ... 3.
   Middle segment strongly bituberculate: entirely reddish; wings yellowish, ... *rutilans.*
3. Claws armed with a tooth within, ... 4.
   Claws bifid, ... 11.
4. Basal vein and cubital vein of hind wings interstitial, . . . 5.
   Basal vein and cubital vein of hind wings not interstitial, . 10.
5. Steel-blue; length 10½ mm., ... *mundulus.*
   Otherwise colored, ... 6.
6. Body entirely black, ... 7.
   Body more or less red, ... 8.
7. Thorax not silvery; abdomen obscurely blue, the fifth segment with pale, sericeous pile, ... *echinatus.*
   Thorax maculated with bright silvery pubescence; abdomen grayish, ... *argenteomaculatus.*
8. Thorax black, subopaque, ... 9.
   Thorax maculated with bright silvery pubescence, . *triquetrus.*
9. Front distinctly striato-punctate, ... *partitus.*
   Front smooth, or very finely punctured, ... *deceptus.*
10. Head and abdomen fuscous; thorax brownish; wings with costal half fuscous, ... *vinicolor.*
    Head and thorax black; abdomen brownish; wings yellowish, ... *exquisitus.*
11. Third submarginal cell very large, fully twice the size of second, not petiolate, ... 13.
    Third submarginal small, not twice the size of second, . . . 12.

12. Abdomen black, with cinereous pile; third submarginal cell petiolate smaller than second; middle segment strongly sulcate down middle, ... *sulcatus.*
Abdomen with first two segments red; third submarginal not petiolate, but greatly narrowed to marginal, somewhat larger than second; middle segment not sulcate, . . . *fulgidifrons.*
13. Wings dark fuscous with purplish or aniline red effulgence; body entirely black, subopaque, ... *rhomboideus.*
Wings subhyaline, or yellowish fasciate with fuscous, . . . 14.
14. Front not sericeous; wings with at least the portion between the dark fasciæ, yellowish. Length 11–12 mm., . . . *scrupulus.*
Front covered with dense sericeous pile; wings hyaline between fasciæ. Length 17 mm., ... *sericeifrons.*
15. All claws bifid, ... 16.
Anterior and middle claws bifid, posterior simple; body dark, four hind coxæ red, ... *ruficoxalis.*
16. Abdomen more or less red, ... 17.
Abdomen not red, ... 20.
17. Wings dark fuscous; first three segments red, ... 18.
Wings subhyaline, darker apically; abdomen entirely red, 19.
18. Head in front not much longer than broad; abdomen without cinereous pile, ... *deceptus.*
Head in front much longer than broad; abdominal segments four and five with cinereous pile, ... *angusticeps.*

[redacted]

Wings with a fuscous cloud in vicinity of marginal and submarginal cells, ... 24.

24. Flagellum serrated beneath; legs except calcaria black, ... *serratus.*

Flagellum even beneath; front and face with golden pubescence; legs including coxæ castaneous; first three segments broadly yellowish at base, ... *resplendens.*

Planiceps perpictus n. sp.

♀.—Black; flagellum beneath fulvous; calcaria whitish; spot on each side of dorsal segments 2–4, and an elongate one on sixth, yellowish; meso- and metapleuræ and part of middle segment with dense silvery pubescence, that on coxæ, face and clypeus less dense; dorsulum at apex and scutellum with dense golden pubescence; clypeus small sparsely punctured, anterior margin truncate; front and face smooth and shining along eyes, the front above and vertex striato-punctate, opaque; space between eyes above greater than combined length of antennal joints 2–4; space between hind ocelli somewhat less than that between them and eyes; first joint of flagellum about one-fifth, or less, longer than second; pronotum as long as dorsulum and scutellum united, its hind margin slightly arcuated; middle segment subtruncate behind, its upper surface divided by a longitudinal furrow; legs spinose but not very strongly, claws bifid; abdomen compressed, longer than head and thorax; wings with superiors dark fuscous, with the median cell (except base and apex), and a fascia crossing through apex of first submarginal, and discoidal and base of third discoidal cells, white, extreme tips and inferiors subhyaline, the latter stained with pale fuscous. Length 17–21 mm.

Chapada, (March, April, October). The species assigned to *varipennis* Perty by Spinola is evidently not that species. *Perpictus* and *varipennis* Spin., (non Perty) are apparently closely related, but I think distinct, although they may yet be proved to be but varieties, *varipennis* Spinola, having but five abdominal spots, whereas *variegatus* has seven.

Planiceps Herbertii n. sp.

♀.—Black somewhat bluish; a spot at each side of dorsal segments 2 and 3, and the sixth almost entirely yellow; calcaria pale; fore tarsi testaceous; flagellum especially beneath and palpi brownish; apical margin of clypeus and mandibles medially, ferruginous; front with brownish pile; clypeus, thorax on sides and beneath with

silvery pile, the apex of dorsulum with pile similar to that of front; clypeus very short, broadly subtruncate, sparsely punctured; front and face depressed along eyes, particularly the face; eyes diverging above, reaching base of mandibles, separated above by a distance about equal to length of antennal joints 2–5 united; fore ocellus in distinct fovea, the space between hind pair greater than that between them and eyes; this intervening space depressed; antennæ stout hardly as long as length of pronotum and dorsulum, first joint of flagellum nearly as long as the two following united; posterior margin of pronotum slightly angular; middle segment subtruncate, the posterior surface a little depressed; legs robust, rather strongly spinose, fore femora less than three times longer than broad, claws bifid; abdomen smooth, compressed beyond base; fore wings fuscous, bifasciate with yellowish, their tips pale, hind wings except apex subhyaline with a milky-blue reflection, second submarginal receiving both recurrent veins. Length 16 mm.

Santarem. One specimen. Seems to be near *Lacordairii* Guérin, but last segment is yellow above, not beneath, and the wings are apparently different.

Planiceps venustus Lep.

Santarem. One example.

Planiceps (?) jugosus n. sp.

♀.—Black; more or less clothed with silvery pile, especially on

[redacted]

clypeus greatly depressed beneath level of face, fore margin rounded; bases of antennæ contiguous, situated below level of face; the latter when viewed from side more prominently convex than usual; front not impressed; eyes a little separated from base of mandibles, diverging slightly above, the space between them at that point nearly equal to the length of antennal joints 3–5 united; space between hind ocelli distinctly greater than that between them and eyes; hind ocelli situated in shallow depressions; antennæ short, first joint of flagellum, if anything, slightly shorter than second; pronotum angulate behind; middle segment subemarginate behind, the lateral angles rounded, legs rather strongly spinose, claws cleft; fore femora at least three times as long as their greatest width; abdomen compressed except at base; wings dark fuscous, with bluish pile, somewhat paler medially, second recurrent nervure received by the cubital vein beyond apex of second submarginal cell. Length 10–15 mm.

Chapada (April, September). Two specimens. Resembles *canescens* Smith, but is larger, less pilose, has shorter antennæ, etc. The bunch of silvery pubescence on each postero-lateral angle of middle segment is apparently a good superficial character.

Planiceps canescens Sm. (=*Aporus canescens* Sm.).

Santarem. Four specimens. Smith's description is too meagre to indicate whether *canescens* is an *Aporus* or *Planiceps*. The specimens in this collection agree with it, however, and they are surely Planiceps.

The Brazilian species of *Planiceps*, excluding *P. varipennis* and *Lacordairii* Guérin, which I have not seen, may be tabulated as follows:

1. Wings fasciate or maculate; abdomen spotted, ... 2.
   Wings fuscous throughout; abdomen unicolored, ... 5.
2. Fore wings black, with the median cell (except base and apex), and a fascia beyond, white, apex subhyaline; hind wings stained with fuscous; dorsulum posteriorly and scutellum with pale, dense, pile; abdomen seven spotted, ... *perpictus*.
   Fore wings fuscous, bifasciate with subhyaline or yellow, . . 3.
3. Pronotum laterally not ridged; length 12 mm. or over, . . 4.
   Pronotum sharply carinated or ridged laterally; length 6 mm.; dorsulum posteriorly with yellow pubescence; second and third dorsal segments with a pale spot on each side, the sixth entirely fulvous, ... *jugosus*.

4. Wings bifasciate with yellow, tips pale; face strongly depressed behind each antennæ; fore femora greatly swollen, their greatest width equal to more than one-third their length; all abdominal spots yellow, ... *Herbertii.*
   Wings bifasciate with subhyaline, tips pale; face not strongly depressed behind antennæ; fore femora not greatly swollen, the greatest width less than one-third their length; spots on segments 2 and 3 pale, on segment 6, fulvous, . . . *venustus.*
5. Second recurrent vein received by the cubital vein far beyond apex of second submarginal cell; body almost without cinereous pile, pertaining to purplish; a patch of silvery pile at sides of apex of middle segment, ... *diverticulus.*
   Second recurrent vein interstitial with second transverso-cubital vein; body with distinct cinereous pile, ... *canescens.*

Salius (Group ?) **transversus** n. sp.

♀.—Blue; flagellum, tip of abdomen and tarsi black; head transverse, broader than long; clypeus subconvex, closely punctured, fore margin somewhat reflexed, subtruncate; front closely and distinctly punctured, strongly depressed before the anterior ocellus; occiput indistinctly punctured; eyes broadly subovate, almost reaching base of mandibles, diverging toward top, where they are separated by a distance nearly equal to the combined length of antennal joints 3–5; space between hind ocelli about equal to half that between them and eyes; antennæ robust, the flagellum slightly thickened medially;

Chapada (April). This species is remarkable for the very transverse head which in many respects is not dissimilar to that of *Ceropales*. The hind claws are missing in the only example in the collection, which was not the case, however, when I first examined it. Then the hind claws, as near as I can remember, were simple, a character which would exclude the species from any of the present known groups of *Salius*. Having nothing at present but my memory to rely on, I would not care to assert that such a character existed, although of the opinion that future specimens will indicate its presence.

Salius (*Cyphonyx*) brevicornis Tasch.

Corumbá (April). One specimen.

Salius (*Cyphonyx*) diversus Sm. (=*Pompilus diversus* Sm.).

Chapada. One specimen.

Salius (*Cyphonyx*) pilifrons n. sp. Pl. IV, f. 16.

♀.—Black; mandibles ferruginous in greater part; tarsi brownish; front and dorsulum posteriorly with dense golden pile, face, clypeus, thorax on sides and beneath and abdomen more or less, with silvery pile; clypeus short, transverse, more than four times broader than long, fore margin broadly subtruncate; eyes reaching base of mandibles, converging somewhat to the top, where they are separated by a distance not quite equal to length of first flagellum joint; space between hind ocelli less than that between them and eyes; first joint of flagellum nearly or quite as long as the two following united; pronotum angulate behind, its antero-lateral angles swollen; middle segment rounded, impressed down the middle; legs strongly spinose, the serration of hind tibiæ, however, not very distinct, claws bifid, longer spur of hind tibiæ equal to less than half the length of first hind tarsal joint; abdomen subsessile, apical margins of ventral segments testaceous; wings subhyaline, tips darker, two broad fuscous fasciæ cross the anteriors, second cubital rhomboidal smaller than third. Length 12 mm.

Santarem. One specimen.

Salius (*Cyphonyx*) opacifrons Fox.

Three specimens of this species, which was originally described from Jamaica, West Indies. Santarem.

Salius (*Cyphonyx*) ichneumoniformis Sm.

One specimen. Santarem. This is the *Pompilus ichneumoniformis* of Smith.

Salius (*Priocnemis*) **tegularis** n. sp. Pl. IV, f. 17.

♀.—Black; legs, tegulæ, middle segment, and base of abdomen, red; head in front and thorax densely clothed with golden pile, in addition to which a long, sparse, pale pubescence is present, especially on thorax beneath; clypeus broadly subtruncate, about three times broader than long; front impressed; eyes not reaching mandibles, if anything diverging above, where they are separated by a distance about equal to the first and half of the second joints of flagellum; space between hind ocelli less than that separating them from eyes; antennæ rather long, acuminate, the first joint of flagellum about one-quarter longer than second; pronotum not strongly angulate behind; middle segment not strongly convex sloping from base to apex, not impressed; legs rather slender, fairly spinose, serration of hind tibiæ distinct, longer spur of latter less than one-third as long as its first tarsal joint, claws with a tooth near base; first abdominal segment subpetiolate; wings subhyaline, faintly tinged with yellow, costal half of anteriors fuscous, third submarginal cell more than twice larger than second. Length 12 mm.

Chapada (October). One specimen.

Salius (*Priocnemis*) **sanguinolentus** Sm.

Santarem. One specimen. This is the *Agenia sanguinolenta* of Smith.

Salius (*Priocnemis*) **rutilus** n. sp. Pl. IV, f. 19.

♂.—Ferruginous; antennæ fuscous apically; clypeus rounded anteriorly; eyes almost reaching base of mandibles diverging above, separated on the vertex by a distance about equal to the first three antennal joints; space between hind ocelli distinctly less than that between them and eyes; antennæ long and slender, first joint of flagellum but little longer than second; occiput slightly prominent behind ocelli; pronotum strongly arcuate; middle segment subconvex, sloping from base to apex; legs tolerably spinose, hind tibiæ strongly serrated, its longer spur nearly or about equal to half the length of first hind tarsal joint; abdomen subpetiolate, the first segment elongate, as long as the two following united; wings subhyaline, two fasciæ and tips slightly darker, nervures testaceous, recurrent veins received by the submarginal cells between base and middle. Length 8 mm.

Santarem.

Salius (*Priocnemis*) **varipes** n. sp.

♀.—Black; antennæ more or less especially beneath, clypeus and mandibles sometimes, four anterior tibiæ and tarsi more or less, the fore femora sometimes, reddish-testaceous; face and clypeus with dense silvery pubescence, the remainder of the body with cinereous pile; clypeus with fore margin subtruncate, about three times or more broader than long; front scarcely impressed; eyes almost reaching base of mandibles, the space between them at top rather less than that at bottom, a little greater than the combined length of antennal joints 2 and 3; space between hind ocelli slightly less than that between them and eyes; pronotum angulate behind; middle segment short, rounded, not impressed, but with a triangular fovea at base above; legs feebly spinose, hind tibiæ delicately serrated, its longer spur fully equal to half the length of first hind tarsal joint; abdomen short, the first segment short, subpetiolate; wings subhyaline, tips darker, the superiors with or without a small fuscous cloud in the vicinity of second submarginal cell, the latter smaller than the third narrowed about one-quarter above, receiving the first recurrent vein in the middle, or slightly before it, third submarginal narrowed about one-quarter above, receiving the second recurrent vein before the middle. Length 6 mm.

Corumbá (March); Chapada (April, November). Four specimens.

Salius (*Priocnemis*) **rufitarsus** n. sp.

♀.—Black; antennæ except five last joints, all the tarsi and fore tibiæ, reddish; pubescence of head and thorax sparse, almost wanting; clypeus rather large, fore margin broadly subtruncate, less than three times broader than long; front impressed; eyes separated from base of mandibles, space between them at top equal or greater than length of antennal joints 2 and 3; space between hind ocelli less than that between them and eyes; antennæ rather stout, the first joint of flagellum nearly one-quarter longer than second; pronotum angulate behind; middle segment short, rounded, with some transverse folds, or rather transversely rugose, not impressed; legs tolerably spinose, hind tibiæ strongly serrated, its longer spur equal to barely one-third the length of first hind tarsal joint; abdomen clothed with pale hairs at apex, shortly subpetiolate; wings subhyaline, tips darker, crossed by two dark fasciæ, second submarginal narrowed about one-quarter above receiving the first recurrent vein a little before middle, third submarginal much larger, narrowed about one-third above, and receiving second recurrent vein in the middle. Length 10 mm.

Chapada (April). One example.

Salius (*Priocnemis*) **citricornis** n. sp.

♀.—Black, with cinereous pile; head and thorax with rather

[redacted]

Salius (*Priocnemis*) **serrulus** n. sp.

♀.—Black; antennæ testaceous, legs darker: mesopleuræ densely silvery, remainder of insect with cinereous pile; clypeus anteriorly and most of mandibles, ferruginous; clypeus strongly depressed transversely, before anterior margin, front scarcely impressed, eyes reaching base of mandibles, almost parallel within, space between them at top about equal to length of antennal joints 2 and 3; space between hind ocelli distinctly less than that between them and eyes; first joint of flagellum about one-fifth or more longer than second; pronotum not distinctly angulate; middle segment rounded behind, slightly impressed down middle, the posterior face more strongly so; legs not strongly spinose, but the hind tibiæ with a remarkably strong serration when the smallness of the insect is considered; longer spur of hind tibiæ fully equal to half the length of first hind tarsal joint; abdomen subcompressed apically, shortly subpetiolate; wings subhyaline, iridescent, the superiors with the base, tips and two cross fasciæ, fuscous, second and third submarginal cells of almost equal size, each receiving the first and second recurrent veins respectively between their base and middle. Length 5 mm.

Corumbá (March). One specimen.

Salius (*Priocnemis*) **setaceicornis** n. sp.

♀.—Black, with a steel-blue reflection and rather densely clothed with cinereous pubescence; clypeus broadly subtruncate, or slightly rounded-out, not much more than twice as broad as long; front not impressed; eyes almost reaching base of mandibles, if anything slightly diverging above, where they are separated by a distance fully equal to the length of antennal joints 1 and 2; space between hind ocelli less than that between them and eyes; antennæ long, setaceous; pronotum angulate behind; middle segment rounded behind, with a slight depression above at base; legs not strongly spinose, the serration of hind tibiæ not distinct, longer spur of the latter equal to somewhat more than half the length of first hind tarsal joint; abdomen shortly subpetiolate; wings subhyaline, the tips and a cross fascia in the vicinity of the second submarginal cell, fuscous, second submarginal smaller than third, narrowed one-quarter above and receiving the first recurrent vein in the middle, third submarginal narrowed nearly one-half above, receiving the second recurrent vein before the middle. Length 9–10 mm.

Chapada (April); Santarem. Three specimens.

Salius (*Priocnemis*) **congruus** n. sp.

♀.—Head and thorax black; legs and abdomen steel-blue, antennal joints 8–12, fulvous, last joint dark at tip, scape and base of flagellum beneath testaceous; head large, much broader than thorax, somewhat subquadrate; clypeus rather flat, broadly truncate, three times or more broader than long; front faintly impressed; eyes almost reaching base of mandibles, slightly, if anything, converging above, at which point they are separated by a distance greater than the combined length of antennal joints 2 and 3; space between hind ocelli much less than that between them and eyes; antennæ long, setaceous, first joint of flagellum but little longer than second; pronotum angulate behind; middle segment sloping gradually from base to apex, slightly convex, slightly depressed in middle before apex; legs scarcely spinose, the serration of hind tibiæ exceedingly delicate, and indistinct, longer spur of hind tibiæ about equal to half the length of first hind tarsal joint; abdomen shortly subpetiolate; wings subhyaline, the tips and two cross fasciæ of the anteriors, dark, second submarginal cell subquadrate, scarcely half the size of third, and receives the recurrent vein between middle and apex, third submarginal narrowed about one-third to marginal, long, receiving the second recurrent vein between base and middle. Length 11 mm.

Santarem. Two specimens. The thorax beneath, postscutellum

[redacted]

dark, second submarginal subquadrate, about one-third the size of third, and receiving first recurrent vein in middle, third submarginal large, narrowed about one-third to marginal, receiving the second recurrent vein between base and middle. Length 12 mm.

Santarem. Two specimens. Bears a superficial resemblance to *congruus*, but is quite distinct in the forms of clypeus, etc.

Salius (*Priocnemis*) **egensis** D. T. (=*Priocnemis opulentus* Sm.).

Santarem. One specimen. This species has a remarkable resemblance to *Pompilus regius* Fabr., but it is purely superficial, as the subpetiolate abdomen and serrated hind tibiæ of *egensis* easily distinguish it from *regius*.

Salius (*Priocnemis*) **nigerrimus** n. sp.

♀.—Deep black; without pale pubescence; fore margin of clypeus subtruncate, or slightly incurved; front impressed, but not strongly; eyes almost reaching base of mandibles, inner orbits parallel, the space between them at top about equal to the length of the first and half of the second joints of flagellum; space between hind ocelli much less than that between them and eyes; antennæ fairly slender, the first joint of flagellum longer than second; pronotum angulate behind; middle segment rounded, feebly impressed down middle, legs not strongly spinose, serration of hind tibiæ distinct, longer spur of hind tibiæ equal to about two-fifths of the length of first hind tarsal joint; wings dark fuscous, with purplish reflection, third submarginal cell receiving the second recurrent vein in the middle, twice as large as the second, which receives the first recurrent vein in the middle. Length 12 mm.

Chapada (April). One example.

Salius (*Priocnemis*) **hexagonus** n. sp.

♀.—Dark steel-blue or green, thorax black; dorsulum and scutellum with golden pile, that on thorax on sides and beneath, silvery; tarsi testaceous; antennal joints seven and eight and ninth beneath, yellow; clypeus large, hexagonal, distinctly punctured anteriorly, broadly truncate; eyes not reaching base of mandibles, space between them at top greater than length of antennal joints 2 and 3; space between hind ocelli less than that between them and eyes; first joint of flagellum fully one-third longer than second which latter is shorter than any of the following, except, perhaps the last; head large, subquadrate, but not wider than thorax; thorax robust; pronotum short, rounded behind, transversely swollen anteriorly;

middle segment rounded, convex, covered with cinereous pile, scarcely impressed; legs not strongly spinose, the serration of hind tibiæ not strongly marked, their longer spur equal to not more than one-quarter of the length of first hind tarsal joint; apical margin of abdominal segment narrowly testaceous, the apical ventral segments with short, stiff yellowish hairs; wings pale yellow, paler apically, tips and a spot in third discoidal cell, light fuscous, second submarginal receiving the first recurrent near apex, rhomboidal, third submarginal three or four times larger than the second, receiving the recurrent vein before the middle. Length 16–17 mm.

Santarem. Two specimens.

Salius (*Priocnemis*) **auratus** n. sp.

♀.—Black, abdomen slightly bluish, shining; head and thorax opaque; sides of scutellum, the postscutellum and middle segment covered with golden pile; face and clypeus and thorax beneath with sparse silvery pile; antennal joints 6–8, or 9, fulvous; clypeus large, somewhat hexagonal, strongly punctured anteriorly, fore margin broadly subtruncate or a little incurved; eyes not reaching base of mandibles, converging somewhat above, separated at the top by a distance about equal to or slightly greater than the combined length of antennal joints 2 and 3; space between hind ocelli equal to more than half that between them and eyes; first joint of flagellum not quite one-third longer than second; pronotum almost arcuate behind, longer than in *hexagonus*, strongly convex or swollen especially at the sides; middle segment short, rounded, broadly and shallowly

[redacted]

Salius (*Priocnemis*) fuscomarginatus n. sp.

♀.—Black; abdomen steel-blue; antennæ from base of sixth joint to base of ninth, orange-yellow; clypeus somewhat hexagonal, fore margin distinctly incurved; eyes converging above, not reaching base of mandibles, separated at top by a distance about equal to length of first joint of flagellum; antennæ longer than in *auratus* fully as long as head, thorax and first abdominal segment; space between hind ocelli equal to more than half that between them and eyes; pronotum angulate behind; middle segment with a broad, shallow furrow down middle, with coarse transverse striæ, becoming obsolete basally; legs tolerably spinose, hind tibiæ hardly serrated, their longer spur hardly equal to one-third the length of first hind tarsal joint; abdomen subpetiolate, the apical segment punctured and clothed with brownish hairs; wings bright yellow, apical margin of anteriors narrowly fuscous; second submarginal cell rhomboidal, not much more than one-third as large as the third, the latter narrowed about one-third above and receives the recurrent vein in the middle. Length 18 mm.

♂.—Colored like ♀, but abdomen black, and the entire insect has pale sericeous pile; clypeus more quadrate, its fore margin much broader and the emargination triangular; striation of middle segment more irregular and not so strong; longer spur of hind tibiæ equal to more than one-third of the length of first hind tarsal joint; third submarginal cell shorter than in the ♀, receiving the recurrent vein before middle. Length 15 mm.

Two specimens (♀ ♂). Chapada (December); Santarem (February).

Salius (*Priocnemis*) convergens n. sp.

♀.—Black somewhat velutinous with brownish pile; dorsulum and scutellum with golden-brown pile; flagellum beneath from second joint, five last joints entirely, inner orbits obscurely, yellow-testaceous; apical margins of abdominal segments testaceous; clypeus transverse, its fore margin broadly subtruncate; eyes almost reaching base of mandibles, strongly converging above, separated at top by a distance about equal to length of scape; ocelli large, space between hind pair fully twice as great as that between them and eyes; first joint of flagellum more than one-third longer than second; pronotum angulate behind, antero-laterally not swollen, but evenly convex; middle segment rounded, parted by a feeble longitudinal furrow, and with a few transverse striæ at extreme apex; legs

strongly spinose, the hind tibiæ distinctly serrated, the saw-like teeth very acute, longer spur of hind tibiæ equal to somewhat more than one-third of the length of first hind tarsal joint; abdomen subsessile, robust; wings pale yellow, the anteriors crossed by a broad fascia, which includes marginal (except base), third submarginal, and apex of third discoidal cells, second submarginal cell somewhat oblong, much smaller than third especially in height, receiving the recurrent vein beyond middle, third submarginal narrowed about one-third to marginal, receiving the second recurrent vein before the middle. Length 17 mm.

Santarem (February). One specimen.

Salius (*Priocnemis*) **vitreus** n. sp.

♀.—Black, somewhat velutinous with brownish pile; the flagellum beneath beginning at joint 2, and last five joints entirely, orange-yellow; legs somewhat testaceous; clypeus transverse rather coarsely punctured anteriorly, its fore margin slightly incurved; eyes reaching base of mandibles, converging above, separated at the top by a distance almost equal to length of second and third antennal joints; space between hind ocelli greater than that between them and eyes; first joint of flagellum more than a third longer than second; front feebly impressed; pronotum angulate beneath, not tumid; middle segment rounded, convex, its upper surface parted by a shallow furrow, smooth and somewhat shining at extreme apex; legs strongly spinose, the hind tibiæ with the serration unusually

or a little incurved; eyes slightly separated from base of mandibles, converging distinctly above, separated at the top by a distance scarcely equalling the first joint of flagellum; ocelli large, the space between hind pair decidedly greater than that between them and eyes; pronotum angulate behind, somewhat swollen antero-laterally; middle segment rounded, feebly impressed, subopaque; legs strongly spinose, the serration of hind tibiæ very strong; longer spur of hind tibiæ equal to a little more than one-third of the length of the first hind tarsal joint; abdomen subsessile, robust, apical segment densely clothed with brown hairs; wings pale fuscous, with purplish reflection, apex paler, hind wings paler, not resplendent with purplish, second submarginal cell narrow, elongate, receiving the recurrent vein a little beyond middle, third submarginal much larger, narrowed about one-quarter above, reciving the second recurrent before the middle. Length 24 mm.

Santarem. One specimen. Differs from the two preceding in color of wings, larger size, etc.

Salius (*Priocnemis*) luteicornis Lep.

Rio de Janeiro (November). One example.

Salius (*Mygnimia*) carinatus Lep.

Chapada (March, October, December); Corumbá (April). Five specimens.

Salius (*Mygnimia*) bituberculatus Guérin.

Three specimens. Rio de Janeiro (October, November); Santarem. This is the *Pompilus bituberculatus* Guérin. Four specimens which may be the male of this species, resemble the female in coloration, are as a rule smaller, and the second ventral segment lacks the long, teat-like tubercles so characteristic of the female. The last ventral plate is carinated down the middle, rounded at apex. These males came from Rio de Janeiro, Santarem and Chapada.

Salius (*Mygnimia*) mammillatus n. sp.

♀.—Resembles *bituberculatus*, but is black, with slight purplish pile; antennæ with joints 1, 2 and 3 except apex, black, four and five orange-yellow, the remainder missing; clypeus with long black hairs, its fore margin broadly subtruncate; front distinctly impressed; eyes just about reaching base of mandibles, converging above, the space betwen them at top about equal to length of fourth antennal joint; ocelli approximate, the space between hind pair less than half of that between them and eyes; pronotum angulate behind; poste-

rior half of dorsulum bearing a medial longitudinal carina, which does reach apex, however; middle segment rounded, shallowly sulcate down middle, crossed by somewhat irregular, coarse rugæ or folds; legs tolerably spinose, the serration of hind tibiæ distinct; longer spur of hind tibiæ less than one-third of the length of first hind tarsal joint; ventral abdominal segments sparsely punctured, becoming more closely and coarsely so on the apical segments, the last one almost scabrous, second ventral with two large widely separated, teat-like tubercles; wings black, with bluish reflection, the superiors subhyaline at apex. Length 28 mm.

Santarem. One specimen. Allied to *bituberculatus*, but clypeus not incurved, dorsulum carinated, tips of superior wings pale, eyes narrowed more to top, etc.

Salius (*Mygnimia*) **dumosus** Lep.

Three females. Rio de Janeiro and Chapada in November. The abdominal tubercles are small and blunt and comparatively approximate in this species.

Salius (*Mygnimia*) **perpunctatus** n. sp.

♀.—Black; flagellum beneath from the second, the last seven joints entirely, orange-yellow; head with long sparse, black hairs; clypeus rather longer than in *bituberculatus*, with a few very coarse punctures anteriorly, the fore margin distinctly incurved; front shining distinctly impressed, and with a short oblique furrow on [redacted]

ments testaceous, the apical ones with long brown hairs; wings yellow, narrowly subfuscous at apex. Length 18–22 mm.

Chapada (December). Two specimens.

Synoptic Table of the New Species of Salius described in the preceding pages.

1. Tarsal claws cleft, ... 2.
   Tarsal claws dentate, ... 4.
2. Head very transverse, flat; antennæ short and thick; entirely blue, including wings, ... *transversus.*
   Head not very transverse, of the usual form; antennæ long and usually slender, ... 3.
3. Front clothed with a dense golden pile; second submarginal cell rhomboidal, scarcely narrowed above; . . . . *pilifrons.*
   Front subopaque without pile; second submarginal cell somewhat triangular, narrowed nearly two-thirds above, ... *opacifrons.*
4. Second ventral segment bituberculate or carinate, ... 21.
   Second ventral segment not tuberculate or carinate, ... 5.
5. Head, thorax, or abdomen more or less reddish, ... 6.
   Head, thorax and abdomen not reddish, ... 8.
6. Entirely red, ... *rutilus.*
   Not entirely red, ... 7.
7. Legs and middle segment reddish; thorax with golden pile, ... *tegularis.*
   Abdomen except apex red; otherwise the insect black; thorax without pale pile; wings fuscous, ... *basirufus.*
8. Wings subhyaline, more or less fasciate or spotted with fuscous, ... 9.
   Wings otherwise colored, ... 15.
9. Wings not distinctly fasciate, with a small, variable cloud in the vicinity of the second submarginal cell; fore tibiæ and tarsi and antennæ testaceous, ... *varipes.*
   Wings bi- or trifasciate, ... 10.
10. Hind tibiæ very strongly serrated, ... 11.
    Hind tibiæ feebly or indistinctly serrated, ... 12.
11. The tarsi and fore tibiæ red, as are also the seven basal joints of antennæ; middle segment somewhat rugose. Length 10 mm., ... *rufitarsus.*
    Legs and antennæ testaceous; mesopleuræ and middle segment with silvery pubescence. Length 5 mm., ... *serrulus.*

12. Antennæ entirely black; body steel-blue with a rather dense cinereous pile, ... *setaceicornis.*
Antennæ more or less yellowish, ... 13.
13. Head subquadrate; clypeus broadly subtruncate; last five antennal joints yellowish, ... *congruus.*
Head transverse as usual, ... 14.
14. Flagellum beneath and joints 7–10 entirely, yellowish; clypeus broadly subtruncate. Length 8 mm., ... *citricornis.*
Flagellum beneath and joints 5–10 entirely yellowish; clypeus subtriangular, its fore margin acute in middle; length 12 mm., ... *clypeatus.*
15. Wings fuscous, ... 16.
Wings more or less yellowish, ... 17.
16. Form slender; entirely deep black, including wings which have also a purplish reflection. Length 12 mm., . . *nigerrimus.*
Form robust; velutinous with pale pile; last five antennal joints entirely and the flagellum beneath orange; wings pale fuscous. Length 24 mm., ... *orbitalis.*
17. Wings not fasciate with fuscous, at the most the apical margins or a spot in the third discoidal cell, fuscous, ... 18.
Wings crossed by a broad fascia, ... 20.
18. Thorax more or less clothed with golden pile, especially on dorsulum and scutellum; wings pale yellow, with a fuscous spot in third discoidal cell, body with a steel-blue reflection,

Wings yellow; dorsulum subcarinate down middle; clypeus broadly emarginate or incurved, ... *perpunctatus.*

Caliourgus pretiosus n. sp.

♀.—Black; tarsi somewhat testaceous; thorax on sides, beneath and on middle segment with dense silvery sericeous pile; head wider than thorax, transverse; clypeus transverse, finely punctured, anteriorly coarsely so, the fore margin a little incurved; front microscopically punctate, the impressed line reaching from base of antennæ half way to ocelli; eyes strongly converging above, reaching base of mandibles, separated above by a distance barely equalling length of fourth antennal joint; space between hind ocelli about equal to that between them and eyes; pronotum subangulate behind; middle segment rounded, not impressed; legs tolerably spinose, serration of hind tibiæ distinct, their longer spur almost equal to two-thirds the length of first hind tarsal joint; abdomen subsessile, ventral segment with large, very sparse punctures; wings subhyaline, the anteriors crossed by two dark fasciæ, the outer of which by far the larger, including the marginal, second and third submarginals, tip of the second and most of the third discoidal cells; second submarginal cell rhomboidal, smaller than the third, receiving the recurrent vein in the middle, third submarginal narrowed fully one-half above, and receives the recurrent vein before the middle. Length 12 mm.

Rio de Janeiro (November).

Caliourgus cinereus n. sp.

♀.—Black; tarsi somewhat testaceous; thorax beneath and on middle segment with silvery pile in certain lights; head wider than thorax, transverse, front impressed for its entire length, microscopically punctured; clypeus rather large, apical half highly polished, fore margin a little incurved; eyes reaching base of mandibles strongly converging above, separated at the top by a distance scarcely equal to length of fourth antennal joint; antennæ long and slender; pronotum subangulate behind; middle segment rounded, shining, not impressed; legs not strongly spinose, serration of hind tibiæ distinct, their longer spur equal to more than half the length of first hind tarsal joint; abdomen subsessile, with sparse, pale pile; wings subhyaline, the anteriors crossed by two fuscous bands, the outer of which the larger, and includes marginal except apex, tip of first submarginal, second and third submarginals, entirely, and apical half

of third discoidal and beyond, second submarginal rhomboidal, receiving first recurrent vein beyond middle, third submarginal larger, narrowed about one-third above and receiving recurrent vein considerably before the middle. Length 10 mm.

Rio de Janeiro (November). One specimen. To the naked eye the insect has a blue-gray appearance, due to the pile with which it is clothed. The third submarginal is differently shaped from that of *C. machetes* Kohl.

Caliourgus machetes Kohl.

A specimen from Santarem is perhaps this species.

Caliourgus idoneus Kohl.

Santarem. One specimen.

Caliourgus nubilus n. sp.

♀.—Black; face, clypeus, thorax on sides and beneath, middle segment and abdomen more or less, with silvery pile, especially obvious in certain lights, that on the abdomen rather sparse and less silvery; clypeus transverse, anteriorly shining and with large sparse punctures; front smooth or indistinctly punctured, hardly impressed; eyes strongly converging above, reaching base of mandibles, separated at the top by a distance scarcely equalling length of fourth antennal joint; space between hind ocelli perhaps a little greater than that between them and eyes; pronotum subangulate behind; [redacted]

Pepsis chrysobapta Sm.

Same locality as *aurozonata*. One male.

Pepsis aurifex Sm.

Chapada. One specimen.

Pepsis speciosa Sm.

Santarem. One specimen.

Pepsis sumptuosa Sm.

Chapada (November, December, March, April). Three females, nine males. The *Pepsis eximia* Sm. (non R. Luc.) is, in my opinion, the ♂ of this species, and I therefore propose the name *confusa* for *P. eximia* R. Luc. (non Smith).

Pepsis citreicornis Mocs.

One specimen. Santarem (February).

Pepsis sp.

Perhaps *brunneicornis* R. Luc., but differs somewhat, from the description of the latter. One specimen, Corumbá (April).

Pepsis pan Mocs.

Chapada (October); Santarem. Two examples.

Pepsis varipennis Pel.

Twenty-one specimens, (3 ♀ and 18 ♂). Chapada (March, April, September, October, November, December).

Pepsis decorata Perty.

One specimen. Santarem.

Pepsis vau-alba Sm.

Four specimens. Chapada (March, September, October).

Pepsis completa Sm.

Twenty-three female, and thirty-three male, specimens.

Pepsis dimidiata Fabr.

Ten female, and nine male, specimens. Chapada (March, October, November); Santarem (February).

Pepsis maeandrina Luc.

Four specimens. Chapada (November, December, January).

Pepsis lucidula Sm.

One specimen. Santarem (April).

Pepsis pretiosa Dhlb.

Three specimens. Chapada (April).

Pepsis venusta Sm.

Chapada (March, April, June, August, October, December); Corumbá (April); Mararu (April); Santarem. Twenty-seven specimens.

Pepsis Pertyi Luc.

Chapada (April). One specimen.

Pepsis helvolicornis Luc.

Santarem. One example.

Pepsis xanthocera Dhlb.

One example. Rio de Janeiro (November).

Pepsis fulgidipennis Mocs.

Chapada (March, April, September); Santarem. Fifteen female specimens.

Pepsis violaceipennis Mocs.

Rio de Janeiro (November); Chapada (December); Santarem; Mararu. Six specimens.

Pepsis crassicornis Mocs.

Fourteen specimens. Chapada (February, March, April).

Pepsis chlorotica Mocs.

Pepsis purpureus Sm.

Two specimens. Santarem (February). This also belongs to the group containing *sagana*, *smaragdinula*, etc.

Pepsis elevata Fabr.

Chapada (April, December); Corumbá (April, May); Uacarizal (February). Nine female, ten male specimens.

Pepsis elongata Lep.

Santarem.

Pepsis pulchripennis Mocs.

Twenty-four specimens. Chapada (March, April, November, December); Santarem.

Pepsis rubescens Luc.

Santarem. One specimen.

Pepsis ferruginea Lep.

Santarem. One example which agrees well with the poor description of *ferruginea*. It belongs in the same group as *P. marginata*.

Pepsis sinnis Luc.

One specimen. Corumbá (April).

In addition to the foregoing species of *Pepsis*, Herr Lucas will shortly describe five new species which form part of this collection.

Explanation of Plate IV.

Fig. 1. Dipogon populator.
Fig. 2. Pompilus echinatus.
Fig. 3. Pompilus echinatus? var.?
Fig. 4. Pompilus partitus.
Fig. 5. Pompilus deceptus ♂.
Fig. 6. Pompilus vinicolor.
Fig. 7. Pompilus argenteo-maculatus.
Fig. 8. Pompilus insignitus.
Fig. 9. Pompilus singularis.
Fig. 10. Pompilus singularis.
Fig. 11. Pompilus rhomboideus.
Fig. 12. Pompilus scrupulus.
Fig. 13. Pompilus ornamentus.
Fig. 14. Pompilus annulipes.
Fig. 15. Pompilus sulcatus.
Fig. 16. Salius pilifrons.
Fig. 17. Salius tegularis.
Fig. 18. Salius basirufus.
Fig. 19. Salius rutilus.

NOTES ON PLANT MONSTROSITIES.

BY IDA A. KELLER.

In one of his "Physiologischen Notizen,"[1] Professor Sachs forcibly calls attention to the exaggerated and erroneous morphological significance which has been attributed to monstrosities. He contends that monstrosities are simply monstrosities and not "suggestions" as to the typical morphological nature of organs as implied constantly by the teachings of the present day morphology.[2] He urges that it is but proper to regard them as the result of a contest between normal tendencies and accidental external agencies. His final and emphatic verdict is: "Monstrosities represent a chaos without law and order."[3] Professor Goebel takes the same point of view, stating that most of the results obtained thus far in the field of teratology must be regarded as useless; the method of reasoning from that which is deformed to that which is normal is a mistaken one.[4] He indicates the direction in which this important branch of botany should be developed when he says: "The problem of this science is not to seek in deformities 'revelations' of nature but to explain how these deformities have come to pass."

At all events deformities in plants are extremely interesting. Although there can be no doubt that the investigator should above

decided whether this suppression primarily caused the deformity by interfering with the normal cell development, or if the center of the disturbance is to be found in the unusual leaf development which thus might have destroyed the activity at the "punctum vegetationis." The abnormal growth had the shape of a cornucopia which was perfectly hollow, and in which every trace of the terminal bud was effaced. The plant was producing shoots at all available points, the normal shoots having an appearance such as is represented in Plate V, fig. 3. These were growing so rapidly in length that long before the young leaves had arrived at maturity, the growing point had advanced considerably beyond them. A glance at the figure although little can be gleaned from it so far as the cause of the disturbance is concerned, will give an idea as to its further effect. The impetus derived from the external favorable conditions of the season which found expression in the luxuriant growth at all parts of the vine, was directed to the pair of leaves below the monstrosity, and at this point a branch emerged; the nearest bit of meristem thus became infused with increased activity and the nourishment supplied was turned aside from its original path and sent in a new direction. Below the deformity the branch had, however, continued to grow in thickness. The abnormal growth was at first evidently purely a local disturbance, there being absolutely nothing unhealthy about the rest of the shoot as is found so often in cases of fasciations due to irregular nourishment or other causes. As already suggested, it will be a difficult matter to decide upon the true and full significance of a monstrosity in each particular case. A single instance as the one described above, will hardly warrant the assumption that it is the expression of a family trait or peculiarity found in allied species. The temptation is great, no doubt, to see in this case a tendency to connate growth to which we are accustomed in *Lonicera flava* and *L. Caprifolium* cropping out as a monstrosity in *L. Japonica*. It must be remembered, however, that it is far more usual to find that plants which ordinarily bear connate or perfoliate leaves (which we are accustomed to regard as later developments) will develop also some leaves which are simply sessile as e. g., *Uvularia perfoliata*. Thus it is that in monstrosities, so far as leaves are concerned, we expect "reversions to primitive types" rather than the acquirement of new characters.

In the article referred to above, Sachs suggests that normal activity can only take place if all phenomena go on with mathematical

exactness.[5] He forces one to realize that it is far more wonderful that nature proceeds with almost absolute regularity in the development of organs if we take into consideration the minuteness of the vegetative point and the quite incomprehensible precision with which molecules must travel each to its particular place of destination. He adds "a few molecules which stimulate the formation of anthers might be supposed to deviate the $\frac{1}{1000}$ part of a millimeter to the right or to the left of their prescribed path, or they might be delayed two or three minutes on their journey" and produce an abnormal growth. Thus it is that in the crowded condition of the floral organs at the growing point and because of the complex differentiation which must take place here at a very early period, that monstrosities in flowers are comparatively frequent.[6] Internal hereditary tendencies, no doubt, come to the fore-ground in a greater or less degree; certainly in the most pronounced manner in such cases e. g., as those cited by Sachs in the Iridaceæ where the inner circle of stamens reappears at times as an abnormal development, and thus the type of the Liliaceæ is repeated. Sachs maintains that we might regard the normal Iris type as a monstrosity.[7] It is quite apparent, however, that such distinctions will depend entirely on the accepted definition of the term monstrosity. It seems reasonable to suppose that the more complex the condition of an undeveloped tissue mass the greater the possible amount of displacement from the normal position, and the less marked externally will be the influ-

[redacted]

the pale surfaces, which form normally the lower side of the leaf, faced each other, while the shiny morphological upper surface of the upper blade was turned toward the sky, while in the lower blade this was turned to the earth. The lower blade then, so far as its morphological structure was concerned, was decidedly in a false position, otherwise, at least in its contour, no irregularity was noticeable, except, perhaps, that it was somewhat smaller than the opposite normal leaf, Plate V, fig. 7. The upper blade was correct as to its position, but its shape was deformed. It had two apices, the midrib having divided at the point of union of the two blades. Besides it was somewhat larger than the opposite normal leaf. The disturbance which caused this monstrosity was also purely a local one since the rest of the plant was in nowise remarkable. Evidently the growing point was twice induced to divide, first in producing two distinct blades, and again in the division of the midrib of the upper blade. A chaos this appears without law and order, and yet even in chaos there is a reason or cause for everything. It would certainly be worth while to know why the under surfaces of the two blades faced each other in such a way as to appear as mirrored images of one another.

MAY 4.

MR. CHARLES P. PEROT in the Chair.

Thirty-four persons present.

The death, April 29th, of Geo. W. Biddle, a member, was announced.

MAY 11.

MR. CHARLES P. PEROT in the Chair.

Twenty-eight persons present.

A paper entitled "On a Collection of Small Mammals from Northeastern North Carolina," by Samuel N. Rhoads and Robert T. Young was presented for publication.

MAY 18.

J. CHESTON MORRIS, M. D., in the Chair.

Thirty-six persons present.

A paper entitled "New Achatinidæ and Helicidæ from Somaliland," by Henry A. Pilsbry, was presented for publication.

[redacted]

in 1877 Professor of Geology. Since 1885 he has been the Director of the Geological Survey of Russia, and since 1886 a member of the Imperial Academy of Sciences at St. Petersburg. In addition he is an honorary member of the Societies of Naturalists of St. Petersburg, Moscow, Kiev, Kazan and Ekaterinburg; of the Mineralogical Society of St. Petersburg; of the Geological Society of Belgium and of the Belgian Society of Geology, Paleontology and Hydrology.

The official list of his more important contributions to science comprises fifty-three published by the Russian Government, in the Journal des Mines, and in the journals the Mineralogischer Gesellschaft, Société Ouralienne, the Académie des Sciences, etc.

Mr. Sager Chadwick was elected a member.

The following were ordered to be printed:—

NEW SPECIES OF MOLLUSKS FROM URUGUAY.

BY HENRY A. PILSBRY.

The following descriptions are based upon material collected in Uruguay by Dr. Wm. H. Rush, U. S. N. The marine shells were obtained at Maldonado Bay by dredging in from 3 to 6 fathoms depth. A list of all the species collected may be found in the "Nautilus" for May of this year, p. 6.

Few coasts of like extent have been so little explored conchologically as the eastern shores of South America from Guiana to Cape Horn. The limits to the southward of the Antillean mollusk fauna are only of late becoming known, largely through the collections made by Dr. von Ihering and others, and recorded by Dall,[1] although the collections made at Rio Janeiro and Bahia by the Wilkes Exploring Expedition,[2] and by the commission of naturalists[3] sent by the Spanish Government, have been of value in this enquiry. Mr. E. A. Smith's catalogue of the mollusks of Fernando Noronha,[4] and numerous records in the volumes on mollusca of the Challenger Reports, further swell the list.[5] It would seem that the [redacted]

abruptly defining regions of diverse physical features. The embouchure of the Plate River may, as Dall has suggested, mark the southern extension of typically Antillean forms, but the endemic southern forms, it seems, extend both to the north and south of it. The main exponent of this southern fauna is, of course, d'Orbigny, whose bulky tome has been of such inestimable value to all later students of South American mollusks.

When we come to the region of Magellan Strait a good many additional forms appear, and the literature is more copious. Among recent papers may be mentioned Dall's report upon forms collected by the "Albatross," Mabille & Rochebrune's Mollusks of the Mission Scientifique du Cap Horn, Smith's "Alert" shells collected by Coppinger, etc.

Pisidium Sterkianum n. sp. Plate VI, figs. 1, 2, 3, 4.

Shell somewhat inequilateral, ventricose, glossy, light yellowish. Dorsal and ventral margins about equally arcuate; anterior end decidedly and broadly truncate; posterior end moderately produced and obliquely rounded. Beaks full but rather small, and not much produced above the hinge-line. Surface very finely striated, becoming a little more coarse near the basal margin; interior grayish-white. Right valve with two lamellar, slightly curved or sinuous, parallel cardinal teeth, the laterals short, high and rather slight. In left valve the laterals are lower and longer. Length 6, height 5, diam. 3·8 mm.

From a creek in the "Prado," Montevideo, Uruguay.

Many specimens were collected. One of those opened contained numerous young, as is often observed in our northern Pisidia.

P. Sterkianum is a large species, about the size of an average *P. Virginicum*. I would identify it with *Cyclas pulchella* Orb. (not Jenyns, = *Pisidium Dorbignyi* Clessin) were it not for the very much smaller size (length 3 millimetres) of that form; the young *P. Sterkianum* of that size being much more compressed than Orbigny's figure of *C. pulchella*. *C. pulchella* was not among Orbigny's South American shells acquired by the British Museum, according to the official catalogue, and is not represented in the Museum, as Mr. E. R. Sykes obligingly informs me.

It is likely that Clessin's *description* of "*P. Argentinum*" and his figure 2*a* were from a specimen of this species; but Orbigny's *Cyclas Argentina*, which Dr. Rush collected at the original locality, is a true *Sphærium*, not unlike *S.* (*Calyculina*) *lacustre* in general ap-

pearance, but not a *Calyculina*. Clessin's figures 1 and 2 are poor copies from the Voy. Amér. Mérid., but the original figures are not good.

We have named this species in honor of Dr. V. Sterki, who has undertaken the difficult task of working up the North American Pisidia.

Pisidium vile n. sp. Pl. VI, figs. 17, 18, 19, 20.

Shell rather inequilateral, quite globose, of a yellowish corneous color. Surface glossy, very finely and evenly striated; anterior end a little straightened or truncate; posterior end narrower, produced and rounded; dorsal and basal margins about equally curved. Beaks large and full, projecting well above the dorsal margin. Interior bluish-white.. Teeth in right valve: a strong, large posterior cardinal, emarginate at tip, and a low, narrow, inconspicuous upper anterior cardinal; laterals very strong and high. In the left valve a low anterior and lower posterior cardinal, the pit between them wide and deep; laterals double, unusually heavy and strong. Length 2·6, height 2·4, diam. 2 mm.

From a small creek in the "Prado," Montevideo, Uruguay.

This form differs from *Cyclas pulchella* Orb. (*Pisidium Dorbignyi* Clessin), described from Maldonado, in being smaller, shorter, with much more projecting, fuller beaks. The very large size of the posterior cardinal tooth in the right valve, and the greater reduction

[redacted]

Length 20·5, height 13·8, diam. 7·5 mm.

Length 20, height 14 mill.

Maldonado Bay, Uruguay.

T. fragilis Penn. is longer in proportion to the height, more prolonged and narrower posteriorly, and more convex.

Semele (Abra ?) Uruguayensis n. sp. Pl. VII, figs. 27, 28, 29.

Shell thin, inequilateral, the anterior end conspicuously longer, convex, smooth except for fine, faint growth-striæ. Surface slightly glossy or dull, pale isabelline, becoming white toward the beaks. Dorsal margins sloping abruptly each side of the beaks, the anterior slope nearly straight, posterior slope slightly convex; anterior end broadly rounded, posterior end rather narrowly rounded below; basal margin regularly rounded, becoming a little straighter near the posterior end. Beaks small, slightly projecting; a faint ridge extending from them to the junction of the posterior and basal margins. Right valve with a small, erect and vertical posterior cardinal, and longer, larger oblique anterior cardinal tooth, and a low, slight, lamellar anterior lateral; no posterior lateral tooth. Left valve with an erect vertical cardinal tooth, no laterals. Interior pure white; pallial sinus very large and deep. Length 9·5, height nearly 8, diam. 4·5 mm.

Maldonado Bay, Uruguay, in 3 to 6 fathoms. Abundant.

Mesodesma Arechavalettoi (Ihering) Pilsbry, n. sp. Pl. VI, figs. 15, 16 (about two-thirds natural size).

Shell shaped much like *M. donacea* Lam., but less abruptly truncated anteriorly, and wider posteriorly. Epidermis light buff; growth-striæ as in *donacea*. Interior with the *pallial sinus very deep, extending beyond the middle of the shell;* lateral teeth weak, the left valve with *a well developed* /*-shaped cardinal retained in fully adult individuals*, with an accessory lamina behind it. Length 74, height 40, diam. 23 mm.

Mar del Plata, Argentina, and Maldonado Bay, Uruguay; young specimens only from the last named locality.

This is the shell mentioned as a species of *Lutraria* in Nautilus, VI, p. 81, It is eaten in Montevideo.

After deciding the species to be new, I submitted a specimen to Professor Wm. H. Dall, who has recently made a special study of the Mactracea, and learned from him that the shell has been named *M. Arechavalettoi* by Dr. H. von Ihering. As I have been unable to find such a name mentioned in the literature examined in the

course of a rather extensive search, I conclude it to be unpublished.

M. ventricosa Gray, from New Zealand, has similar weak lateral teeth, but it is lower, shorter, and more swollen in the middle.

Types are no. 70,486 coll. A. N. S. P.

Corbula Lyoni n. sp. Pl. VII, figs. 21, 22, 23.

Shell solid and strong, nearly equivalve, very inequilateral, compressed, oblong, the beaks near the anterior third; dorsal margin straight and sloping posteriorly, convexly sloping in front; anterior end wide, rounded; posterior end narrow, obliquely truncate, terminating below in an acute angle; basal margin straightish in the middle, rather abruptly rising near the posterior angle. Outer surface dull whitish. Right valve slightly larger, noticeably surpassing the left behind the beaks and along the posterior two-thirds of the basal margin, where it closely overlaps the margin of the left valve. The valves are about equal in convexity, and have the same sculpture. A posterior area is conspicuously defined on each valve by an acute keel running from the beaks to the posterior angle; the keel is considerably bowed downward; above this the surface is closely, sharply and subregularly costulate, the riblets straight, obliquely descending in the direction of growth lines. In front of the keel, the basal half of the valves, or more, has very coarse and irregular concentric folds; on the rounded anterior end the folds become more regular and more numerous. The upper part

the lower part of the valves less coarse. I know of no other *Corbula* at all similar to this remarkable species.

At Dr. Rush's suggestion, this fine species is named in honor of Commander H. L. Lyon of U. S. S. "Yantic."

Corbula Iheringiana n. sp. Pl. VII, figs. 24, 25, 26.

Shell very inequivalve and very inequilateral; moderately convex, somewhat *Donax* like in general form. Whitish under a dull, light brown cuticle. Right valve much the larger and more convex, projecting beyond the other above, the posterior three-fourths of the sinuous basal margin conspicuously surpassing the left valve. The upper margin is sloping and conspicuously concave posterior to the beaks, the posterior end truncated; basal margin moderately or slightly arcuate; anterior end obliquely truncated in front of the beaks, becoming rounded below. Surface rather irregularly wrinkled-striate, sometimes (as in the specimen figured) with some rather coarse folds on the smaller valve.

Length 9, breadth 5·5, diam. 3·8 mm.

Maldonado Bay, Uruguay, in 3 to 6 fathoms.

This is a species of peculiar contour, the valves of very unequal size and dissimilar shape, even for this genus. I have been able to find among the numerous forms described from the Antillean region, none much resembling this.

The specific name is intended to honor the only working malacologist in South America to-day. Naturalists may well congratulate themselves that the learned and virile Director of the Museu Paulista is adding to laurels fairly earned in the Fatherland, another and American wreath, by his enlightened labors upon the South American fauna.

Crassatella (Eriphyla) Maldonadoensis n. sp.

Smaller than *E. lunulata* Conrad, decidedly longer in proportion to the height, the anterior dorsal slope somewhat convex instead of straight, and far shorter than the posterior slope, while in *E. lunulata* it is straight, concave near the beaks, and longer than the other slope. The lunule is more deeply excavated, and the posterior end of the shell rounded, not subangular; beaks less elevated, less acute, directed forward more than in *E. lunulata*. Exterior white, variously suffused, maculated or interruptedly rayed with pink; having low and inconspicuous, but coarse concentric wrinkles. Interior pink in the cavity of the valves, white below the pallial line.

Teeth, hinge and interior otherwise as in *E. lunulata*. Length 4·75, height 4, diam. 1·9 mm.

Maldonado Bay, in 3 to 6 fathoms.

Numerous specimens collected are very much alike except in pattern of color.

Turbonilla dispar n. sp. Pl. VI, figs. 5, 6, 7.

Shell moderately attenuated, composed of about 8 somewhat convex whorls after the nucleus, the latter globose, partly immersed, with very short low spire of less than two whorls. Sculpture of spiral grooves at unequal intervals, with oblong punctures along the grooves; the upper part of spire, especially when slightly eroded, marked with series of square punctures. Color light brown.

Alt. 8·2, diam. 2·3 mm.

Maldonado Bay, Uruguay, in 3–6 fathoms.

Distinguished by the grooved and punctate sculpture, and the globose, Naticoid nucleus.

Turbonilla Uruguayensis n. sp. Pl. VI, figs. 8, 9, 10.

Shell of the usual slender tapering form. the greatest diameter contained about 3½ times in the height; bluish-white, thin but rather strong; the sides straight, whorls a trifle convex, with slightly but distinctly impressed sutures. Whorls 11, not counting the tilted nucleus; the two earlier whorls finely costulate or smooth from wear; succeeding whorls down to the end of the seventh with deep, regu-

[redacted]

folds reversed; in number 9 to 10 on the last whorl, and about the same number on the preceding. These are crossed by rounded spiral threads which are somewhat lamellose from the fine growth-striæ. There are about 13 or 14 principal spirals, but in the region of the periphery five or six of the intervals are occupied by minor threads. Aperture one-half the total length of shell, small, long-oval; passing below into a very narrow, parallel-sided canal nearly as long as the open oval portion. Outer lip thickened and 7-toothed within; siphonal fasciole conspicuous, convex, leaving a narrow umbilical chink. Alt. 11·5, diam. 5·8 mm.

Maldonado Bay.

The general appearance of this species is somewhat like *Urosalpinx cinereus* on a small scale. The spire is more slender, the folds stronger in proportion, and the anterior canal narrow.

Urosalpinx Rushii n. sp.

Shell shortly fusiform, thick and solid, white under a dull light brown epidermis. Whorls about 6½, the earliest 1½ convex and smooth, the rest sculptured and convex, the last whorl convex and robust, excavated below. Sculpture: numerous low longitudinal folds, quite distinct and regular on the whorls of the spire, but subobsolete on the body-whorl; spiral cords about 43 on the last whorl, every fourth cord decidedly wider and more prominent, the middle one of the three intervening larger than the other two; on the spire, or in young specimens, the spirals are alternately larger and smaller. The surface is roughened and minutely lamellose throughout. Aperture pure white within, about three-fifths the total altitude of shell, long-oval, the anterior canal contracted, narrow, considerably recurved, about one-third as long as the open portion of the aperture; outer lip thick, with about 7 low denticles within; columella straight, vertical. Umbilical chink minute, the umbilical region large, excavated, surrounded by a convex, prominent siphonal funicle. Operculum very thin, with the nucleus near the base. Length 29, breadth 16 mm.

Maldonado Bay, Uruguay.

Compared with *Urosalpinx cinereus* the spiral sculpture is far finer, longitudinal folds subobsolete on the last whorl, canal contracted, etc. In *Tritonidea tincta* the sutures are not so deep, the aperture channelled posteriorly and the umbilicus obsolete; otherwise the two species are considerably alike.

Halistylus circumstriatus Pilsbry. Pl. VI, fig. 21.

Nautilus, XI, May, 1897, p. 7.

Maldonado Bay, in company with *H. columnus* Dall.

Ancylus Rushii Pilsbry, n. sp. Pl. VI, figs. 11, 12, 13, 14.

A small, very strongly hooked species. Aperture narrow, wider anteriorly. Spire produced beyond the right margin. More elevated and more curved and narrower than *A. concentricus* Orb. or *barilensis* Moric., which are both much larger; decidedly narrower, more convex and more curved than *A. obliquus*, of which some hundreds of examples were collected by Dr. Rush. Length 3·75, breadth of aperture 1·7, height 1·5 mm.

Creek in the "Prado," Montevideo, Uruguay.

EXPLANATION OF PLATES VI AND VII.

Plate VI, figs. 1, 2, 3, 4. Pisidium Sterkianum.
" " " 5, 6, 7. Turbonilla dispar.
" " " 8, 9, 10. Turbonilla Uruguayensis.
" " " 11, 12, 13, 14. Ancylus Rushii.
" " " 15, 16. Mesodesma Archavalettoi (Ihering) Pilsb. about two-times natural size.
" " " 17, 18, 19, 20. Pisidium vile.
" " fig. 21. Halistylus circumstriatus.
Plate VII, figs. 21, 22, 23. Corbula Lyoni.

EXTERNAL FEATURES OF YOUNG CRYPTOCHITON.

BY HAROLD HEATH.

The genus *Cryptochiton* includes the most highly modified individuals in the order of the Polyplacophora so far at least as excessive growth of the mantle and the consequent diminution in size of the tegmentum is concerned. In the adult no trace of the tegmentum is visible, the articulamentum alone remaining, being completely hidden within the mantle. While it is held by many that this represents the last stage of a process by which the mantle gradually encroached upon and finally destroyed the tegmentum, Reincke[1] considers it to be a primitive condition from which the remainder of the Chitons have been modified. The following observations on the young of *Cryptochiton stelleri*, are of interest in this connection.

In many places along the coast of California this species is of frequent occurrence. In and about Monterey Bay they are quite common out beyond tide marks, where the water is from six to twelve feet in depth. Sometimes they may be seen in the dark hollows and crevices, slowly moving about in search of food, which consists mainly if not entirely, of plants.

On July 14, 1896, two young specimens were found on the underside of stones at the extreme low tide mark. They were placed in an aquarium at the Hopkins Seaside Laboratory and were kept for several weeks but they were always sluggish, remaining quiet for days together in the dark corners or under stones. They did not exhibit any peculiarities worthy of note.

They were oval in outline, the broader end being anterior, and were of the same size, having a length of 27 mm. and greatest width of 15 mm.

Adult *Cryptochiton* are of a dark red color, sometimes obscurely blotched with white. The young were unlike in coloration, one having a light orange-yellow color shading to orange on the mid-dorsal line; the other was of a light green also darker in the region of the shell. In both the tint was lighter on the ventral surface. The bunches of calcareous spines that cover the dorsal surface contain

[1] Zeit. für wiss. Zool. Bd. XVIII, 1868.

some of a crimson color and these modify to a considerable extent the general color.

In adults there are from 71–80 gills. In the young there are 56 arranged as in the adult. Anteriorly they shade off into minute papillæ not visible to the naked eye.

Full grown *Cryptochiton* are covered on the dorsal surface with groups or tufts of calcareous spines so closely crowded together that the mantle is almost or entirely concealed. In the young the groups are smaller and much more scattered (Plate VIII, fig. 1); in addition are multitudes of small crimson spines on both the ventral and dorsal aspects of the mantle. Reincke, and especially Blumrich[2] have worked out the development of the spine in several species of *Chiton*. It forms above and outside the epithelial cell, from which it develops, and as the spine increases in length, its base with its underlying cell becomes pushed into the mantle and a hollow is thus produced. Many spines forming these hollows occur in such positions as to produce a circular groove and the small area of epithelial cells surrounded by this groove becomes a papilla. In young *Cryptochiton* the entire mantle surface is thrown into these papillæ which become clearly outlined by the spines which form in the channel about them (Plate VIII, fig. 4). These small spines not collected into tufts are elliptical in cross section and the calcareous portion imbedded in an organic basis is made up of four pieces. [redacted]

are probably homologous to the small ones of the general mantle surface but, unlike them, consist of but one calcareous shaft imbedded in chitinous matrix which remains after decalcification.

Pilsbry[3] has placed the *Cryptochiton* as an offshoot from the Acanthochitoid stock. In the Acanthochitidæ there are always sutural tufts or groups of spines corresponding in number and position to the valves of the shell. In this relation it is interesting to note that we have a similar arrangement in the young *C. stelleri*. On each side of the mid-line are tufts opposite each valve that are larger than any others in this region, and show a distinct regularity of position (Plate VIII,fig. 3). There are multitudes of other groups, but they are scattered irregularly over the mantle and do not in any way correspond to the position of the valves.

Along the median dorsal line, corresponding to the posterior portion of each valve, is a series of eight openings. They are about 0.5 mm. in diameter and through them the shell is plainly visible. Carefully dissecting out the valves, which are pure white and of the same shape as those of older specimens, a well defined tegmentum is visible (Plate VIII, fig. 2). In most cases it exhibits growth lines and obscure ribbing of no definite pattern. The color is generally white, sometimes slightly greenish, and is generally tinted posteriorly and in some cases anteriorly with light red pigment. No tegmental sense organs (æsthetes) were seen.

On the valves of specimens almost fully grown, in a position corresponding to the tegmentum on young shells, one may see a small brown spot of about 0.5 mm. diameter which Middendorff[4] named the *nabel* or umbo. This investigator figures a section where a plug of some brown organic material something like chitin projects from the umbo about half way through the mantle. This is covered by columnar or pavement epithelium and while it is spoken of as the "navel" by Middendorff, he states that he is unable to explain its significance. It beyond doubt represents the opening through the mantle as found in young specimens and consists of the degenerate tegmentum over which the mantle has closed and partially fused.

Thus it is seen that no Chiton so far as known exhibits throughout life a condition where the shell is wholly concealed within the mantle. By its development we are justified in saying that *Crypto-*

[3] Manual of Conchology. Vol. XV, Part 57.
[4] Mem. de l'Acad. St. Petersbourg. Tome VI, 1849.

chiton is not a primitive Chiton, but represents the last of a series which has undergone successive modification, by which the tegmentum, orginally the same size as the articulamentum, has gradually disappeared. Paleontological evidence also supports such a conclusion.

EXPLANATION OF PLATE VIII.

Fig. 1. Anterior portion of the mantle showing the tegmentum of the first and second valves. This shows the accurate arrangement of the spines in this region. × 12.

Fig. 2. First and second valves showing the size of the tegmentum. × 6.

Fig. 3. Young *Cryptochiton* showing the tegmenta and sutural tufts. × 3.

Fig. 4. A group of spines seen from above, with the characteristic arrangement of the small mantle spines (represented by dots) about the papillæ.

Fig. 5. A cross section through a tuft (as in fig. 4) showing the development of the spines.

NOTES ON A COLLECTION OF SMALL MAMMALS FROM NORTHEASTERN NORTH CAROLINA.

BY SAMUEL N. RHOADS AND ROBERT T. YOUNG.

The series of small mammals forming the basis of the following paper was recently collected by Mr. Young, and, with the exception of about fifteen specimens donated to Dr. C. Hart Merriam,[1] was presented to the senior author prior to Mr. Young's departure to the far west in the interests of the U. S. Department of Agriculture. Since leaving Philadelphia Mr. Young has forwarded to the Academy of Natural Sciences copious notes on his itinerary and the faunal and floral features of the country where the collection was made, besides his personal observations and a list of all the species of mammalia coming under his notice.

Owing to the hurried preparation of these notes it has been thought best to entirely rewrite and rearrange them for publication in the following form. Where Mr. Young's notes are given verbatim they appear in quotation marks without additional reference. Quotations from other sources will be specially referred to under their several author's names.

"The points visited were Chapanoke, Perquimans County, from March 8th to 24th, (1897), and Currituck, Currituck County, from March 27th to April 14th, two days being also spent at Elizabeth City, Pasquotank County. Chapanoke is about eighteen miles from Albemarle Sound, a small stream which drains the swamp-land in this vicinity flowing thence into the Sound. Currituck is situated directly on Currituck Sound, the waters of which, as well as those of Albemarle Sound, are nearly fresh. The country through all this section of North Carolina is mainly low and swampy, the interior upland soils being a fertile sandy loam, while those of the lowlands along the Sounds are chiefly sand. Most of the land is cultivated, although considerable timber still remains in the swamps. The swamp-lands during winter and spring are usually under from one to four feet of water, but in summer they are nearly dry. The

[1] Dr. Merriam very kindly furnished a list, with annotations, of the species sent to him by Mr. Young, for use in this connection.—S. N. R.

principal timber growths of the swamps are Cypress, Gum, Oak, Swamp Maple and Birch, with some Dogwood, Elm and Ash. The upland timber consists mainly of two species of short-leaved Pine with abundant undergrowth of Holly, *Ilex glabra*, though in some places are extensive tracts of Juniper. Along the Sound coast Holly and Laurel grow abundantly, the shores of Currituck Sound being also here and there dotted with Alders. One of the chief woodland plants is *Apios tuberosa*, and the green briar makes itself obnoxious wherever one may chance to wander. In marshy spots and along the ditches which have been dug for draining the fields, Cane, *Arundinaria tecta*, occurs abundantly, and in many places in the woods is a soft carpet of *Hypnum* moss. In this moss were found several mice and one or two shrews. A few of the trees in the low woods and swamps were adorned with Spanish moss (*Tillandsia*), but this is not common. The Yellow Jasmine was also abundant and blooming. Along Currituck Sound are extensive marshes covered with cat-tails and a thick dense *Juncus* (?) 2 to 3 feet high. A small patch of *Juncus setaceus* at Chapanoke contained runways in which were taken two specimens of *Synaptomys*. But little success in trapping was had at Chapanoke, small mammals apparently being quite scarce."

The region covered by Mr. Young's researches is of much faunal interest, being the borderland of distribution between such distinc- [redacted]

The following is a list of the species seen or obtained by Mr. Young, with annotations on each.

1. **Lepus**——sp?. Hare.

"Only a few individuals of this genus were noted. They were probably *sylvaticus*, but as none were secured this is uncertain. *L. palustris* may also occur."

2. **Synaptomys cooperi stonei** (Rhoads). Carolinian Bog Vole.

Synaptomys helaletes Merriam. Proc. Biol. Soc. Washn., 1896, p. 59.

"Two specimens, male and female, the latter containing four well advanced embryos, were taken in a patch of *Juncus setaceus* in a damp piece of open ground bordering pine woods at Chapanoke, March 11, 1897. The runways were filled with cut stems of the *Juncus*, on which they had evidently been feeding."

The identification of these *Synaptomys* has necessitated a careful examination of a series of about forty accurately measured and well preserved skins and skulls of *cooperi* from eastern North America from New Brunswick to Roan Mountain, North Carolina, a few of which are in the collection of the American Museum of Natural History, New York, but the majority were collected by the senior author in Pennsylvania and New Jersey. By means of this exceptional series from the debatable region lying between the northern and southern extremes of the eastern distribution of *cooperi*, together with the data presented by Dr. Merriam's "Revision" of the genus (*l.c.*), the following conclusions have been reached :—

1. The type locality of *Synaptomys cooperi*, according to the known history of the original (type) specimen and the published consensus of recent naturalists, may be defined as lying within a radius of fifty miles of Hoboken, New Jersey, either in northern New Jersey, southern New York or eastern Connecticut.

2. *Synaptomys cooperi* Baird, is represented by the following species and subspecies :—

a. Cooper's Bog Vole. *Synaptomys cooperi* Baird; Mam. N. Amer., 1857, pp. 556–558.

Type locality unknown; probably northern New Jersey or southern New York.

Geographic distribution.—Lower Alleghenian fauna,[1] intergrading southwardly into subspecies *stonei*, northwardly into subspecies

[1] Dr. J. A. Allen's nomenclature of faunal areas is here used.

fatuus, and westwardly into subspecies *gossi*.

General characters.—Similar in colors and appearance to *Microtus pennsylvanicus*, but smaller and with a very short bicolor tail. Contrasted with *S. c. stonei* the body measurements are somewhat less, but in the same proportions. The skull of *cooperi*, however, is relatively smaller than in *stonei* and the dentition much weaker. The relative proportions of the skull in *cooperi* are about the same as in *fatuus*, but the rostrum and mandibles of *stonei* and *gossi* are relatively much broader and more massive.

Measurements.—Average of 3 old adult females and 2 old adult males from Sussex County, New Jersey and Monroe and Cambria Counties, Pennsylvania; total length 118 millimeters; tail vertebræ 16.5; hind foot 19.5. Skulls of 2 adult males, Sussex County, New Jersey and Monroe County, Pennsylvania; greatest length 26.5; greatest breadth 16.

b. Canadian Bog Vole. *Synaptomys cooperi fatuus* (Bangs); Proc. Biol. Soc. Washn., 1896, pp. 47, 48.

Type locality.—Lake Edward, Quebec.

Geographic distribution.—Lower east Canadian and upper Alleghenian faunas.

General characters.—As in *cooperi*. Skull much smaller and dentition relatively weaker. Under parts washed with buff on belly (not clear gray or plumbeous-gray as in *cooperi*). Tail nearly unicolor.

Measurements.—Average of nine adults, 4 females and 5 males, from the following localities: New Jersey, Cumberland County, 3; Cape May County, 1; Atlantic County, 3; North Carolina, Perquimans County, 2; total length 125 m. m.; tail vertebræ 20; hind foot 20. Skulls of two adult males from southern New Jersey; greatest length 27.8; greatest breadth 17.7. A large adult male skull from Chapanoke, North Carolina, is 28.5 millimeters long by 18 broad, and represents the extreme maximum size of the Dismal Swamp form which Dr. Merriam named (*l. c.*) *helaletes*.

d. Great Plains Bog Vole. *Synaptomys cooperi gossi* (Merriam). Proc. Biol. Soc. Washn., 1896, p. 60.

Type locality.—Neosho Falls, Kansas.

Geographic distribution.—Great Plains fauna.

General characters.[4]—Similar to *cooperi* but larger, with relatively small audital bullæ. Dentition heavy, as in *stonei*. Color above, decidedly shaded with reddish-brown.

Measurements.—Average of 6 specimens from type locality; total length 120 m. m.; tail vertebræ 20.5; hind foot 19. Skull measurements, not available.

3. **Microtus pennsylvanicus nigrans** Rhoads, subsp. nov. Albemarle Meadow Vole.

Type, No. 3,494 ad. ♀, Col. of S. N. Rhoads. Collected by R. T. Young at Currituck, Currituck County, North Carolina, April 7, 1897.

General characters.—Similar to *Microtus pennsylvanicus* of eastern Pennsylvania and New Jersey, but larger and darker, with a nearly unicolor tail and distinctly sulcate upper incisors in the majority of adult skulls.

Colors.—Above dark brownish slate-black, with a well defined darker median dorsal area of slaty-black, but sparingly mixed with the dark brown of sides. Dark brown of sides extending around and over lower parts from lips to vent, leaving no line or area of demarcation between upper and lower body colors as in *pennsylvanicus*, and in the series of 9 specimens examined, showing little trace of the ashy or hoary cast of underparts so conspicuous in 90 per cent. of a large series from eastern Pennsylvania, northward. Cranial characters as in *pennsylvanicus*.

[4] These characters and measurements are chiefly summarized from Dr. Meriam's "Revision" of the genus. I personally examined all the Goss specimens and can confirm the color diagnosis.—S. N. R.

Measurements.—(of type) Total length 175 m. m.; tail vertebræ 50; hind foot 23; ear, from crown 9. Average of 4 adults from Currituck: total length 176; tail vertebræ 50; hind foot 23; ear 8. Average of 4 adults from Philadelphia County, Pennsylvania (type locality): total length 165; tail vertebræ 44; hind foot 21; ear 9. Skull (of type): total length 29; greatest breadth 16.2; length of mandible 18.

A very large series, comprising nearly 500 specimens of *pennsylvanicus* from the eastern States and Canada, makes it possible to define accurately the variations in *M. pennsylvanicus.*' A study of this material shows clearly a diminution in size and intensity of coloration as we go northward from the southern border of its range. Typical *pennsylvanicus* from Philadelphia County is exactly intermediate between the large meadow mice of eastern North Carolina and the small ones of Quebec and the lower Hudson Bay regions. The lightest colored eastern individuals come from the sea coasts of New England and represent an imperfectly differentiated race approaching *M. breweri*, easily distinguishable from the darker animal of the interior uplands of New England and the maritime coasts of New Jersey. It is possible that the Albemarle Vole, like its associates, *Sorex fisheri* and *Blarina telmalestes*, will be found to have no connectant habitat with its northern representative, *M. pennsylvanicus*, but prove to be an insulated species.[5] So far as I can discover, the type locality of *M. p. nigrans* is much farther south than

[redacted]

measurements, that the so-called *scalopsoides* of Bachman is even a tenable subspecies.

South Carolina and Georgia specimens, however, may show greater differences. Owing to the highly fossorial habits of this vole, spending like a mole nearly its whole life underground, it is not subjected to the ordinary vicissitudes of environment which have caused subspecific variations in other members of its family.

"Common at Currituck, where they were obtained in runways in the escarpment along shore and in the *Juncus* in wet woods along the shore."

5. **Fiber zibethicus** (L.). Muskrat.

Concerning the only specimens of this species, sent to him from Currituck, Dr. Merriam informs me by letter: "The muskrat has the small teeth of the ordinary *zibethicus*, thus differing from the Dismal Swamp form.

"Muskrats were reported as fairly common at Chapanoke. None were taken there, but at Currituck they were numerous in the marshes, where two specimens were secured."

6. **Peromyscus leucopus** (Raf.). Carolinian Deer Mouse.

Twelve skins from Chapanoke and ten from Currituck represent this species. They do not differ in color and measurements from a large series taken at the same time in southern New Jersey, which are considered typical of Rafinesque's species.

"The commonest species met with, being taken in all kinds of situations."

7. **Peromyscus gossypinus** (LeC.). Northern Cotton Mouse.

Two adult specimens from Currituck are the most northern record of this species known to us. The strong distinctions, both cranial and external, separating this species from its small congener and associate *leucopus* at Currituck, are apparent at a glance. The habitat of the two overlaps at this point precisely as it was found to do by the senior author in the bottom lands of western Tennessee, where the *mississippiensis* form of *gossypinus* occurs.

The specimens were "obtained in a patch of *Juncus* in a wet piece of woods on Currituck Sound."

8. **Peromyscus aureolus** (Aud. & Bach.). Golden Deer Mouse.

Four specimens from Chapanoke are in the collection.

9. **Reithrodontomys humulis** (Aud. & Bach.). Eastern Harvest Mouse.

Sixteen skins, two only of which were taken at Chapanoke, are in the Rhoads' collection. "Several specimens were taken at both

Chapanoke and Currituck. At the latter place the conditions were more favorable and they were much more common. Here they were trapped in marshy meadows grown up with *Juncus* and grass. Such places are scarce at Chapanoke, and there they were also obtained in cultivated fields and in patches of *Hypnum* in the pine woods."

10. Mus musculus (L.). House Mouse.

Two skulls and one skin of this foreigner are in the collection. No label is attached to the skin, but from the numbers on the skulls they evidently were taken at Chapanoke.

11. Sciurus carolinensis Gmel. Carolinian Gray Squirrel.

No specimens taken. "Only one observed at Currituck, but reported to be fairly common in all localities."

12. Putorius vison lutreocephalus (Harl.). Carolinian Mink.

"Several skins seen, which had been taken at Chapanoke, but no specimens obtained either there or at Currituck. They were reported as common in suitable localities at each place. They are considered very destructive to poultry."

13. Procyon lotor (L.). Raccoon.

"Reported to be fairly common. One or two skins were seen, taken near Chapanoke."

14. Blarina telmalestes Merr. Dismal Swamp Mole Shrew.

Three skins with skulls, two from Chapanoke and one from Cur-

we consider that *brevicauda* and *carolinensis* have been pretty conclusively proved to intergrade in western North Carolina and Tennessee. For the present, however, it is more logical to assume that the two so-called '*brevicauda*' specimens from Chapanoke are immature *telmalestes*, that *telmalestes* does wander beyond the confines of swamps and that it in no case intergrades with its neighbor *carolinensis* nor ever overlaps the habitat of *brevicauda*, from which it should, therefore, be considered a distinct species.[6]

15. Blarina brevicauda carolinensis (Bachm.). Carolina Mole Shrew.

The difference in size between the small adult mole shrew from Chapanoke in the Rhoads' collection and the large specimens already referred to under *telmalestes*, is so great as to allow no question of a possible intergradation. The skull of the former barely measures 19 mm. in total length, while the latter average nearly 23 mm. The hind foot of the former is 11 mm. long, that of the latter 14 mm.

16. Sorex fisheri Merr. Fisher's Shrew.

"One specimen was secured in a runway in pine woods at Chapanoke." The color and measurements of this specimen, which is just reaching maturity, are intermediate between those given respectively for *longirostris* and *fisheri* in Dr. Merriam's "Revision" of the genus. The two may eventually be found to intergrade on the outskirts of Dismal Swamp.

SUPPLEMENTARY LIST OF SPECIES NOT OBSERVED BY MR. YOUNG BUT REPORTED TO HIM BY OTHERS.

1. Didelphis marsupialis virginiana (Kerr). Virginia Opossum.

"Said to be common at both Chapanoke and Currituck."

2. Dorcelaphus americanus (Erxl.) Virginia Deer.

"Said to be not uncommon in the wild regions about Chapanoke."

3. Sciuropterus volans (L.). Carolinian Flying Squirrel.

"Reported at Chapanoke."

4. Ursus americanus Pallas. American Black Bear.

"Not rare in the wilder sections of country near Chapanoke."

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[6] A specimen of typical *brevicauda*, recently taken in eastern Gloucester County, Virginia, indicates not only that *telmalestes* is connected with the northern form but that *carolinensis* is a distinct species whose habitat overlaps *brevicauda* in these regions.

5. **Lutra hudsonica** Lacèp. North American Otter.

"A few reported from the swamps around Chapanoke."

6. **Putorius noveboracensis** Emmons. Carolinian Weasel.

"Reported at Currituck. Probably occurs sparingly throughout the Albemarle region."

7. **Lynx ruffus** (Gueld.). Eastern Bay Lynx.

"Rare, but of general distribution."

JUNE 1.

MR. THEODORE D. RAND in the Chair.

Twenty-two persons present.

JUNE 8.

CHARLES SCHAEFFER, M. D., in the Chair.

Twelve persons present.

A paper entitled "Cypræa lynx Deformed by Disease," by John Ford was presented for publication.

JUNE 15.

The President, SAMUEL G. DIXON, M. D., in the Chair.

Papers under the following titles were presented for publication:—

"A Revision of the West American Flying Squirrels," by Samuel N. Rhoads.

"New and Little-known North American Bees." by T. D. A. Cockerell.

JUNE 22.

The REV. HENRY C. McCOOK, D. D., Vice-President, in the Chair.

Thirty-nine persons present.

Papers under the following titles were ordered to be printed in the Journal of the Academy:—

"Certain Aboriginal Mounds of the Georgia Coast," by Clarence B. Moore.

"Inhumation and Incineration in Europe," by the Marquis de Nadiallac.

JUNE 29.

MR. CHARLES MORRIS in the Chair.

Ten persons present.

Alonzo H. Stewart, M. D. and Charles E. De M. Sajous, M. D. were elected members.

Prof. A. Karpinski was elected a Correspondent.

The following were ordered to be printed:—

A REVISION OF THE WEST AMERICAN FLYING SQUIRRELS.

BY SAMUEL N. RHOADS.

The recent acquisition of four fine specimens of an apparently undescribed Flying Squirrel from the San Bernardino Mountains, California, having made it necessary to go pretty fully into the relationships and nomenclature of the described forms inhabiting the Rocky Mountain and Coast Ranges of America, the author has secured the loan of most of the available specimens of these in our eastern museums and made them the basis of the following study. Before passing to their consideration I would gratefully acknowledge the loan, through Mr. F. W. True, of the study series of western *Sciuropterus* from the Smithsonian Institution, also the permission to examine specimens in the American Museum of Natural History, and the loan of a valuable series of skins and skulls from British Columbia from the collections of Messrs. E. A. and O. Bangs, through the courtesy of my friend, Mr. Outram Bangs.

Besides these and a series of about forty specimens in my private collection, I should specially refer to those in the collection of the

cies or "variety" of *volucella*, with *alpinus* and *oregonensis* as its synonyms. Until 1896, Dr. Allen's ruling, at least in reference to the inseparability of the northern and southern forms of our eastern Flying Squirrels as distinct species, was generally accepted.

In that year Mr. Outram Bangs, having made a study of a much better series of specimens than was accessible to Dr. Allen, showed[2] that the habitats of *sabrinus* and *volans* overlapped, the two forms not intergrading over this common territory. So far as my study of the western forms has made it necessary to consult the eastern species, the verdict of Mr. Bangs appears fully sustained, and the cranial and external characters of the *Sciuropteri* inhabiting our country from the Rocky Mountains westward to the Pacific seem to equally justify their specific separation from any of our eastern species.

The first name specifically given by a naturalist to a western Flying Squirrel was imposed by Richardson in the London Zoological Journal of 1828, pages 519, 520. In this place he describes a squirrel taken on the second Franklin Expedition of 1825–'26 as follows:—

"12. *Pteromys alpinus* [here follows Latin description of characters], Rocky Mountain Flying Squirrel; yellowish-brown above; tail flat, longer than the body, blackish-gray, flying membrane with a straight border. Size greater than that of the Siberian Flying Squirrel. Hab[itat].—The valleys of the Rocky Mountains."

In 1829[3] he more fully described the animal, comparing it with *Sciuropterus sabrinus* and reducing it to a variety of that species. From this article we are enabled to fix definitely the type locality of *alpinus* to be the headwaters of the "Elk" [=Athabasca] and "South Branch of the Mackenzie" [=Peace] Rivers, on the eastern drainage of the main range of the Rocky Mountains in northwestern Alberta and east central British Columbia. From Richardson's account of the itinerary and labors of Drummond, who collected the type specimens, the one first mentioned was probably taken by Drummond when he returned after his fifty mile exploration of the Columbia Portage Road "to the head of Elk River, on which he passed the winter [1825–'26] making collections."[4]

It has been found impossible to secure any good specimens of

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[2] Proc. Biol. Soc. Wash., 1896, pp. 162–167.
[3] Faun. Bor. Amer., 1829, pp. 195, 196.
[4] Ibid, Introd., pp. xvi, xvii.

Sciuropterus from nearer the type locality of *alpinus* than Stuart Lake, B. C., lying just west of the Pacific-Arctic watershed separating the affluents of the Peace River and the Frazer River, about 150 miles west of the type locality of the "Elk River" specimen and 100 miles west of the head of the Smoky River branch of the Peace River,[6] all about at the same latitude of 54°. An excellently preserved skin of an adult male *Sciuropterus* from Stuart Lake with separated skull belonging thereto, and careful flesh measurements and data made by Mr. W. E. Traill, sent by him to the Provincial Museum of Victoria, B. C., and donated to the writer by Mr. John Fannin, is considered in this study as typical of the essential specific characters of Richardson's *alpinus*. From its faunal position, however, in a region less elevated and more humid than that which forms the type locality of *alpinus*, it is, as would be expected, darker colored. Richardson's description in the *Fauna Boreali Americana*, as well as Audubon and Bachman's plate of *alpinus*, indicate an animal lighter colored (yellowish-brown above) than the reddish-brown *sabrinus*, conditions which our knowledge of other mammals from the more arid eastern slopes of the Rocky Mountains would lead us to expect. The Stuart Lake specimen, though too dark to answer for a type of the color characters of *alpinus* is, nevertheless, in size and proportions as contrasted with *sabrinus*, specifically the same as *alpinus*, and will be so considered in the absence of speci-

of sooty on tail, feet and head, and in the whiteness of the hair of underparts. The skin specimen, on the other hand, is between russet and wood-brown above, the underside being washed with dirty cream-buff and light Isabella color. The latter specimen has the appearance of being once immersed in alcohol. The great length of the hind foot (42 mm., when dry) and the general lightness of underparts are the only reliable characters in these specimens which go to justify the specific separation of *sabrinus* and *alpinus*, and their distinction from *fuliginosus*.

In the third volume of their Quadrupeds of North America, Audubon and Bachman undertook to redefine the *alpinus* of Richardson and appropriate the name to themselves.[6] They describe and figure it from a specimen which we may infer from their account was taken by Townsend when crossing the Rocky Mountains in southeastern Idaho.[7] Professor Baird, in commenting on this specimen, remarks[8]: "There is a Flying Squirrel in the museum of the Philadelphia Academy of Natural Sciences labelled '*Pteromys alpinus*, Columbia River, Dr. Townsend,' but I am unable to say whether it is really the type of Bachman's description or not. The locality is probably the Rocky Mountains, as described by Bachman, nearly all of Townsend's specimens having been labelled Columbia River, whether collected there or on the overland march from St. Louis." With this specimen in hand I find it difficult to regard it as the type of Audubon and Bachman's description and plate of *alpinus*. In both color and measurements it differs considerably from their diagnosis.

The second western Flying Squirrel to receive a new specific name was the "*Pteromys oregonensis*" of Bachman described in 1839 in the Journal of the Academy of Natural Sciences of Philadelphia from a specimen taken by J. K. Townsend in the "pine woods of the Columbia River near the sea." This type specimen yet exists in good condition in the collection of the Academy of Natural Sciences of Philadelphia. It remains as originally mounted in the flight position, with membranes widely extended, the limbs at right angles to the body and the skull within the skin, apparently unbroken. Though somewhat faded by exposure to the light it closely

[6] Quad. N. Amer., 1854, pp, 206–208.

[7] They made the mistake of thinking (l. c., p. 207) that Townsend crossed the mountains by the same route as Drummond, and that the specimens of each were topotypes!

[8] Mam. N. Amer., 1858, p. 289.

matches specimens of the same race from nearby localities on the Pacific Coast of British Columbia and Washington. The original description of Bachman, as well as the plate of Audubon and Bachman, are very fairly diagnostic of *oregonensis* except the part relating to the size and shape of the ears and of the flying membrane, in which latter character of *Sciuropterus* both Bachman and Richardson were misled by the distorted condition of dried specimens in a bad state of preservation and wholly lacking reliable measurements.

To my knowledge no other names than those already treated of have been proposed for the *Sciuropteri* coming within the scope of this paper. In the following synopsis I have recognized *alpinus* as the type of a western group, distinct from the eastern species and separable into four subspecies, *alpinus* of the eastern Rocky Mountain districts, *oregonensis* of the Pacific Coast lowlands, *fuliginosus* of the Cascade Mountains, and *californicus* of the southern Sierra Nevada range.

I have been unable to examine any specimens from large areas undoubtedly tenanted by this genus, the most noticeable lack being from the United States east of the Cascade Range and the more northerly coasts of Alaska. It is probable that the form recorded from Cook's Inlet, Alaska, by Turner,[9] will prove separable from [redacted]

1. **Sciuropterus alpinus** (Richardson). Rocky Mountain Flying Squirrel.

1828. *Pteromys alpinus* Richardson, Zool. Jour., (Lond.), III, p. 519.
1829. *Pteromys sabrinus* var. *β. alpinus* Richardson, Faun. Bor. Amer., I, p. 195.
1854. *Pteromys alpinus* Audubon & Bachman, Quad. N. Amer., III, p. 206.
1877. *Sciuropterus volucella*, var. *hudsonius* Allen, Monog. N. Amer. Rod., p. 655.
1881. *Sciuropterus volucella*, a *alpinus* Trouessart, Cat. des Mam., p. 67.

Type locality.—Rocky Mountains, at the sources of the Athabasca River ("Committee's Punch Bowl") and the Peace River (Smoky River?), Alberta.

Geographic distribution.—Main range of the Rocky Mountains between latitudes 40° and 60° (Uintah Mountains to Fort Liard[11]). Northern and southern limits unknown.

Habitat.—Dense pine forests of the mountains.

General characters.—Size, largest of the American Flying Squirrels, with relatively longer tail, larger, narrower skull, flatter brain case, longer rostrum and nasal bones, shorter postorbital processes, and more massive dental armature than *sabrinus*.[12] Colors above and below lighter (grayer below, more tawny above), lacking the tawny of underparts and rusty or cinnamon shades of upper parts of *sabrinus*.

Color.[13]—(Probably based on Drummond's winter specimens "from the head of Elk River"). "The end of the nose is hair-brown and the fur about the mouth and on the sides of the nose has a dark, smoke-gray color. * * * * The surface of the fur on the back has a yellowish-brown color, without any tendency to the more red hue of the back of *Pt. sabrinus*. The fur of the throat and belly is a grayish-white, without any tinge of buff color; the tail has a flat, oblong, oval form, and has a blackish-brown color above, and is merely paler beneath."

Dimensions.—Of Richardson's type (probably from dry skin); total length 336 millimeters; tail vertebræ 133; hind foot 38. Of Audubon and Bachman's type of *alpinus* (dry, stretched skin?); total length 342; tail vertebræ 133; hind foot 38. Measurements taken by collector from carcass of an adult male, No. 345, Coll. of

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[11] Assuming the specimens recorded by Dr. Allen (l. c.) to be typical.
[12] For characters of *sabrinus* compare Bangs, Proc. Biol. Soc. Wash., 1896, p. 162.
[13] The color characters of this diagnosis are based wholly on Richardson's description of the types in Fauna Boreali Americana. Audubon and Bachman's description and plate of *alpinus* appear to confirm these in every particular.

S. N. Rhoads, from Stuart Lake, B. C.; total length 309; tail vertebræ 143; hind foot 40.

Average of seven adults of *sabrinus* (*fide* Bangs, l. c.); total length 278.6; tail vertebræ 130.4; hind foot 37.6. Skull measurements of the Stuart Lake specimen: occipito-nasal length 41.5; greatest breadth 25[14]; length of nasals 12.5; greatest length of mandible 23. Skull measurements of an adult male *sabrinus* from Maine: occipito-nasal length 38; greatest breadth 23; length of nasals 11; greatest length of mandible 22.

General remarks.—Making due allowance for the measurements given by Richardson, Audubon and Bachman of their types of *alpinus*, and comparing these with the accurate field measurements and complete skulls of the specimens of the *alpinus* group now available from numerous localities in the Rocky and Cascade Mountain regions, it seems just to consider all the mountain forms of *alpinus* as specifically distinct from *sabrinus* both in greater size and in the relative proportions of the skull and extremities. The lowland forms of *alpinus* closely agree in cranial characters with the type, but in their diminished size approach *sabrinus*.

A fine winter skin with skull and collector's measurements, from Camp Davidson, on the Yukon River, near the eastern boundary of Alaska, is larger than any other specimen of American *Sciuropterus* I have handled. Its measurements are given in the table. Its

[redacted]

2. Sciuropterus alpinus fuliginosus Subsp. nov. Cascade Mountain Flying Squirrel.

Type No. 1,058, ad. ♂, Col. of S. N. Rhoads. Collected by Allan Rupert on the Cascade Mountains near Martin Station, Kittitass Co., Washington, at an elevation of about 8,000 feet, March, 1893.

Geographic distribution.—Higher elevations of the Cascade, Coast and Sierra Nevada Mountains, probably intergrading southward into subspecies *californicus*, and in the coast lowlands to *oregonensis*.

Habitat.—Spruce forests of the higher mountains.

General characters.—Size and proportions as in *alpinus;* colors darker, more sooty, browner above, beneath brownish-yellow.

Color.—Winter and summer pelages very similar, not glossy. Color of type: hair of back, rump, upper sides, top of head and base of tail, minutely tipped with broccoli brown,[16] the brown tips poorly concealing, even in the smoothest and fullest pelaged specimens, the blackish-slate of under fur, giving the upper parts a dull mottled slaty-drab appearance. Upper basal half of tail like back, remainder becoming more slaty, the terminal third blackish-slate with a smoke-gray cast. Upper surface of flying membrane like upper terminal third of tail. Upper surfaces of feet mouse-gray; the fur covering hind toes gray. Lower surface of tail smoke-gray, becoming more broadly bordered with blackish-slate toward distal end. Entire underparts light drab-gray, with a wood-brown tinge at base of throat and along lower margin of flying membrane; a nearly white narrow stripe extends along extreme outer lower margin of flying membrane in contrast with the dark colors of upper margin; basal $\frac{3}{8}$ of hairs of underparts plumbeous. Hairy soles of feet and

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parietal plane and great relative mastoid width as contrasted with skulls of *sabrinus*. In color the oldest example, No. 6,959, Col. of E. A. and O. Bangs is darker, less rusty, wood-brown than Maine *sabrinus* above and the tail is more heavily shaded with black above and below. The sides of face, lips, eyelids and ears are strongly shaded with black on a smoke-gray ground and the underside of body tinged with wood brown, darkest on sides of abdomen. Upper feet, grayish plumbeous. Total length 304 mm. tail vertebræ 146; hind foot 40; ear from crown, 16. The other specimen No. 6,960 is darker (blacker) above, the brown having an olive cast. This form is lighter colored and smaller than *fuliginosus*, darker and smaller than *alpinus* and paler and larger than *sabrinus*. Its cranial characters, as above outlined, are quite distinct from those of *sabrinus* and agree with *alpinus* in their differences from *fuliginosus*. I propose to name it for Mr. Outram Bangs, *Sciuropterus alpinus bangsi*, subsp. nov. Type, No. 6,959, Col. of E. A. & O. Bangs, from Idaho County, Idaho. Col. by Harbison and Bargamin, Raymond, Idaho.

[16] Color-standards of Ridgway's Nomenclature are used in this paper.

outer surfaces of ears drab-gray; sides of head smoke-gray. A narrow circle of blackish slate surrounds the eyes; whiskers black.

Cranial characters.—Presumably as in *alpinus*. Compared with *sabrinus* from Maine the skull is much larger, more elongate and depressed. The greatest width of parietals is less than their greatest (lateral) length, whereas in *sabrinus* these proportions are reversed. In adult *fuliginosus* the widths of frontal constriction before and behind the postorbital processes are about equal; in *sabrinus* the posterior width greatly exceeds the anterior interorbital constriction. Owing to the interorbital depression of frontals and their postorbital inflation, together with the pug-nosed shape of the nasals in *sabrinus*, the lateral facial profile of that species is decidedly dished. In *fuliginosus* the facial profile is straight, or in some cases slightly convex. The incisors in *sabrinus* are deep chrome, in *fuliginosus* and its western allies they are orange-rufous.

Dimensions (of type taken in flesh).—Total length 317 millimeters; tail vertebræ 153; hind foot 40; ear, from crown (relaxed) 18; length of carpal fascia 25. Average of 3 adults from type locality (in above order): 310; 146; 41.5; 17; 26. Skull of type: occipito-nasal length 40; greatest breadth 23.8; length of nasals 13; frontal constriction behind postorbital processes 9; interorbital constriction 8.2; greatest length of mandible 23.2. Average of 3 adults from type locality (in above order): 41; 24; 12.8; 8.5; 8; 24.2.

General remarks.—Subspecies *fuliginosus*, from its close resem-

[redacted]

Specimens examined.—Alaska, 1; British Columbia, 8; Washington, 4.

3. Sciuropterus alpinus californicus subsp. nov. Sierra Madre Flying Squirrel.

Type No. 3,487, ad. ♀, Col. of S. N. Rhoads. Collected by R. B. Herron on the San Bernardino Mountains (near Squirrel Inn), San Bernardino County, California, at an elevation of 5,200 feet, June 5, 1896.

Geographic distribution.—Sierra Madre Mountains, California.

Habitat.—Mixed pine and oak belt of the mountains, living in deserted woodpecker burrows in dead pine stubs 10 to 30 feet from the ground.

General characters.—Proportions much as in *alpinus*, but somewhat smaller and with a relatively shorter hind foot and tail. Color palest (?) of the American flying squirrels.

Color (of type).—Above, including whole upper surface, except nose, forehead, flying membrane, fore and hind legs and terminal ⅔ of tail, between drab-gray and wood-brown; bases of upper body hairs slate color, this shade predominating on upper surfaces of flying membrane and the fore and hind legs. Hind and fore feet brownish smoke-gray, fading on the toes to whitish smoke-gray. Upper basal third of tail like back, remainder of tail becoming dark smoke-gray. Sides of face and neck and across rostrum pale ashen smoke-gray. Black whiskers fading to smoke gray along the terminal half. Ears drab-gray within and without. Mouse-gray orbital ring scarcely appreciable. Whole underside of body, head and limbs nearly uniform pale, buffy or yellowish-gray, with a French gray cast caused by the darkening of the exposed basal portions of the hairs and becoming nearly pure white on throat, lower fore legs and inner margins of thighs. Furred soles of hind feet and whole underside of tail pale drab.[17]

Cranial characters.—Smaller, but otherwise similar to those of *fuliginosus*. The incisors are but slightly darker than those of *sabrinus*.

Dimensions (of type taken in the flesh).—Total length, 286 millimeters; tail vertebræ, 127; hind foot, 38; ear, from crown (when dry), 16; length of carpal fascia, 24. Average of four suckling adult female topotypes (in above order): 292, 133, 38,—, 23. Skull, of type: occipito-nasal length, 39; greatest breadth, 23.8;

[17] This color name is not used by Ridgway; in fact, nearly all the colors of this subspecies are not to be matched in the Nomenclature of Colors.

length of nasals, 11.5; frontal constriction behind postorbital processes, 8.4; interorbital constriction, 8.3; greatest length of mandible, 21.8.

General remarks.—The San Bernardino or Sierra Madre flying squirrel, true to its environment, has assumed the characteristic paleness of the Southern California mountain mammalia as contrasted with their near allies of the Cascade Range. In size and general proportions it seems to be intermediate between *fuliginosus* and *oregonensis;* in color it probably comes closest to *alpinus*, but is much grayer. Its skull is almost as small as in *oregonensis*, and the characteristic relative narrowness of the posterior frontal constriction distinguishing the *alpinus* group from *sabrinus* is very pronounced.

Mr. Herron makes the following interesting notes on this subspecies: "Those four flying squirrels are the only ones I have taken in this country. They were all taken from dead pine trees or stumps, in holes made by the red-shafted flicker, from 10 to 30 feet from the ground. * * * * Unlike the eastern species, I do not believe they have their young in nests made of leaves placed in the branches of trees, as I have never seen nests of this kind in the mountains, but I think they have their young in these deserted woodpeckers' nests. Their food, I think, is mostly acorns. They were all taken at an altitude of about 5,200 feet, near Squirrel Inn. I would say they range from four to six thousand feet altitude, as they have never been seen in Bear Valley some 30 miles farther east on the

Geographic distribution.—Lower elevations of the Pacific Slope, from southern Alaska to northern California, intergrading at higher elevations with *fuliginosus* and southwardly toward a lighter colored race more closely allied to *californicus*.

Habitat.—Coniferous and deciduous forests.

General characters.—Size intermediate between *alpinus* and *volans;* tail long and slender; colors darkest of the American flying squirrels.

Color (winter pelage).—Above, including body, crown of head, hips and shoulders Mars-brown with a russet shade and tinged with clay color, the whole being darkened by numerous black tipped hairs. Upper surfaces of feet, hams, shoulders, flying membrane, ears and tail more or less shaded with seal-brown to slate-black; in darkest individuals from Sumas, B. C., these parts are dark clove-brown to black. In the type the black has faded to dark Isabella color, and the brown to light russet, the darker terminal part of the tail being slaty russet. In British Columbia and Alaska specimens of *oregonensis* the upper tail and feet are in marked contrast with the colors of the back and rump, becoming slaty at the base of the tail, and in darkest specimens this becomes dull black over the terminal third of the tail, the hairs of the upper base of the tail being more or less mixed with dark wood-brown or broccoli-brown. In the type the contrast between tail and body colors is less marked. Another color peculiarity of *oregonensis* is the slight difference in shade of upper and lower caudal pelages and the contrast between the lower tail and lower body colors. In all the other American forms the tail colors agree closely with those of the corresponding surface of body.

Lower surface of body, from base of neck to vent, Isabella-color, tinged with rusty on thighs, breast and flying membrane, and more or less darkened by the exposed slate-gray bases of hairs, this color reaching more than half way to the hair tips. Lower surface of fore legs, a spot on chin and a narrow median area from breast to vent, whitish. Region around mouth and eyes and nasal pad blackish. Sides of face and across rostrum light slate gray.

Dimensions (of type, *fide* Bachman, taken from skin).—Total length, 302 millimeters; tail vertebræ, 132; hind foot, 39; ear, from crown, 15; carpal fascia, 23.5. Average dimensions of four adults, two from Oregon, two from Sumas, B. C., in above order: 288, 135, 39, 17, 23. Skull: average of three adults—total length, 39;

[redacted] *SCIUROPTERUS ALPINUS* GROUP OF WESTERN NORTH AMERICA.

Locality.	Total length.	Tail vertebræ.	Hind foot.	Ear, from crown.	Carpal fascia.	Remarks.
[redacted] N.W. Alberta, "Elk Riv." ?	"336"	"134"	"38"	"12.8"		Richardson's type.
[redacted] S. E. Idaho. ?	"342"	"127"	"38"	"9.7"		Aud. & Bach. type.
[redacted] Martin, Kittitass Co., Wash.	317	153	40	18	25	Type.
[redacted] Martin, Kittitass Co., Wash.	304	140	42	17	25	Topotype.
[redacted] Martin, Kittitass Co., Wash.	304	140	42	17	28	Topotype.
[redacted] Stuart Lake.	309	143	40		26	
[redacted] Camp Davidson, Yukon River.	335	150	42.5		25	
[redacted] Bernardino Mts. "Sq. Inn." S. B. Co.	298	140	38		20	Topotype.
[redacted] Bernardino Mts. "Sq. Inn." S. B. Co.	280	127	37		24	Topotype.
[redacted] Bernardino Mts. "Sq. Inn." S. B. Co.	286	127	38		24	Type.
[redacted] Bernardino Mts. "Sq. Inn." S. B. Co.	305	149	38		25	Topotype.
[redacted] Mouth of Columbia River.	"302"	"132"	"39"	"15"	"23.5"	Type.
[redacted] Clackamas."	263	114	39	17	23	Alcoholic.
[redacted] Klamath.	275	127	39	17	23	
[redacted] Puget Sound.	316	135	40.5	16.5	24	Alcoholic.
[redacted] Puget Sound.	314	137	40	17	23	Alcoholic.
[redacted] Sumas.	315	140	40		23	
[redacted] Sumas.	300	140	39		23	
[redacted] Stave Lake, Coast Range.	283	140	40		22	

[redacted] less intermediate between that race and *fuliginosus* in size. The alcoholic specimens taken by Ken-
[redacted] agree more nearly in size with *fuliginosus*, with which form they perhaps belong in the table. The

greatest breadth, 23.8; length of nasals, 11.8; greatest length of mandible, 22; frontal constriction behind post-orbital processes, 8.5; interorbital constriction, 7.5.

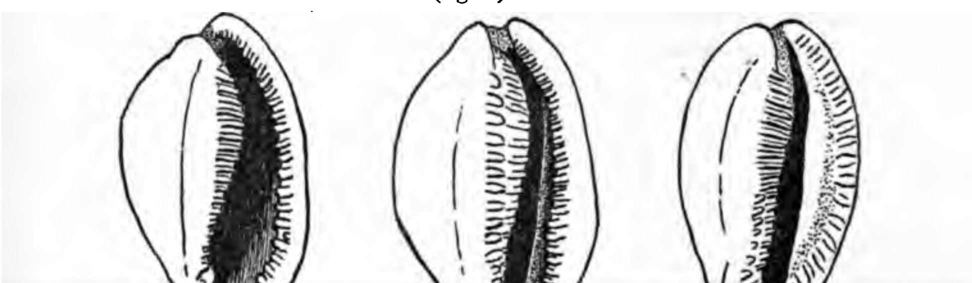
General remarks.—A study of *oregonensis*, as represented by a fair series of specimens extending from Tongas, Alaska, to northern California, seems to indicate that three forms of this small, dark colored type inhabit the Pacific Coast lands, the typical form found from northern Oregon to southern Alaska being darkest and brownest, becoming larger and more rusty northward, and smaller, grayer and more tawny southward. Lack of specimens from the two extremes of its distribution compel me to reserve a decision on these points. In some respects the differences between *oregonensis* and the other subspecies of *alpinus* recognized in this paper seem almost specific, but in some of the specimens from intervening localities I find such a strong indication of intergrading with *fuliginosus* that this separation seems unwarranted.

Specimens examined.—Alaska, 2; British Columbia, 5; Washington, 4; Oregon 5; ? California, 1.

CYPRÆA LYNX DEFORMED BY DISEASE.

BY JOHN FORD.

A very remarkable series of shells comprising sixty or more specimens of diseased *Cypræa lynx* (figures 1, 2, 3) was recently secured by the writer while examining a barrel of mixed species of *Cypræa* that apparently came direct from Singapore, E. Indies. As much of the animal matter remained in all of the shells it seems quite probable that they were barreled, indiscriminately, as soon as obtained. The action of the disease appears to have been the same in all the specimens, the chief abnormal characters being a pallid and emaciated appearance of the outer margin of the right lip, and the outward bow-like curve of the same (fig. 1). In some instances from within



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JULY 6.

PROFESSOR HENRY A. PILSBRY in the Chair.

Twelve persons present.

JULY 20.

MR. CHARLES MORRIS in the Chair.

Nine persons present.

A paper entitled "New Australian Mollusks," by Henry A. Pilsbry was presented for publication.

AUGUST 3.

MR. BENJAMIN SMITH LYMAN in the Chair.

Seven persons present.

Patagonian Tertiary fossils.—PROF. H. A. PILSBRY spoke of a small collection of fossils from near Cape Fairweather, Patagonia, collected by the Princeton University Expedition to that region in charge of Mr. Hatcher.

The general aspect of the fauna as represented by these fossils is decidedly Magellanic; but the presence of large oysters, *Cardium* and *Turritella*, differentiate it from the recent fauna of Cape Horn. Negative characteristics are also significant, dominant Magellanic genera as *Nacella*, *Photinula*, etc. being absent.

The forms common to the Cape Fairweather deposit and the recent fauna are *Trophon laciniatus*, *Calyptræa* (probably), and *Magellania venosa*. The extinct forms are *Trophon inornatus*, *Turritella innotabilis*, *Pecten actinodes*, *Ostræa*, two species. The other forms enumerated below are not sufficiently well preserved to base conclusions upon. Of the species supposed to be extinct, the *Trophon* and *Turritella* are nearer to recent forms than to anything yet known from the Patagonian Tertiary.

The evidence of so limited a number of species is not absolutely conclusive as to the age of the deposit, but so far as it goes indicates that it is Pliocene. Certainly no argument for greater antiquity could be based upon the data now available, whatever a more complete knowledge of the fauna of the beds in question may reveal.

TROPHON LACINIATUS Martyn. Specimens 6 to 6·5 cm. in length.

TROPHON INORNATUS n. sp.

Form as in *T. lacinatus* or somewhat more obese; surface without lamellæ or spiral cords, smooth except for growth-lines. Specimens measure:

Alt. 50, diam. 34 mm.
Alt. 85 mm.

Trophon inornatus.

CALYPTRÆA *cf.* MAMILLARIS Brod. Internal casts show no features incompatible with the recent *C. mamillaris* of the west coast of South America.

TURRITELLA INNOTABILIS n. sp.

Shell long-conic, of about a dozen slowly increasing whorls, which are but slightly convex, but become decidedly so below, the latter two or three being well rounded. Sculpture on the lower whorls of five rounded and subequal spiral cords separated by intervals of about the same width, traversed by one to three (generally two) sharp threads. Earlier whorls have three primary spirals parted by intervals bearing a single strong thread, and still earlier the threads disappear from the intervals.

Internal casts show well rounded whorls, the last just mentionably flattened above the periphery, faintly angular at the junction of the outer with the basal regions, the latter less convex but hardly flattened.

[redacted]

AUGUST 17.

MR. BENJAMIN SMITH LYMAN in the Chair.

A paper entitled "The North American Species of Argia (Order Odonata)," by Philip P. Calvert was presented for publication.

The death of J. Sergeant Price, a member, on the 16th inst. was announced.

AUGUST 24.

MR. BENJAMIN SMITH LYMAN in the Chair.

Eight persons present.

AUGUST 31.

MR. USELMA C. SMITH in the Chair.

Eleven persons present.

A paper entitled "Description of Two New Species of Cerion" by H. A. Pilsbry and E. G. Vanatta was presented for publication.

SEPTEMBER 7.

MR. CHARLES MORRIS in the Chair.

Fourteen persons present.

SEPTEMBER 14.

MR. CHARLES P. PEROT in the Chair.

Twenty-nine persons present.

A paper entitled "The Annual Molt of the Sanderling," by Witmer Stone, was presented for publication.

Scalpellum and Balanus from Texas.—MR. PILSBRY exhibited fossil valves of *Scalpellum* and *Balanus* collected in Texas by Mr. Charles W. Johnson, and described the former as follows:

SCALPELLUM CHAMBERLAINI n. sp. Tergum (fig. 1) very thick and strong, of very irregular contour, the scutal and carinal margins subparallel. Apex conspicuously recurved; occludent margin very convex; carinal margin sigmoid, being markedly concave from the apex two-thirds of the distance to basal angle, then bending in the opposite direction; scutal margin slightly sinuous, nearly straight, along the portion adjacent to the scutum, then abruptly deflected, the two-fifths near-

[redacted]

The irregular shape of the tergum, exceptionally convex, occludent and concave, carinal margin, and unusual angulation of the scutal margin are sufficiently unusual features to insure recognition of the species, although the tergum is generally one of the less satisfactory plates for description. The discovery of the carina will be looked for with interest, as the position of the species in the genus cannot be predicated without a knowledge of that valve.

The species is respectfully dedicated to the Rev. Leander Trowbridge Chamberlain, D. D., whose liberal and enlightened interest in the "Lea Collection of Eocene Mollusca" must be regarded as one of the important factors in the present revival of the study of American tertiary paleontology.

A single scutum of *Balanus* was collected by Mr. Johnson from the Eocene of Black Shoals, Brazos River, Texas. It is somewhat worn, and the species remains doubtful until further remains come to light.

SEPTEMBER 21.

The President, SAMUEL G. DIXON, M. D., in the Chair.

Twenty-seven persons present.

SEPTEMBER 28.

The President, SAMUEL G. DIXON, M. D., in the Chair.

Twenty persons present.

The death of Johannes Japetus Smith Steenstrup, a Correspondent, June 20, 1897, was announced.

The following were elected members:—

Thomas H. Conarroe, M. D., G. A. Mueller and Mrs. Catherine Mueller.

The following was ordered to be printed:—

NEW AND LITTLE-KNOWN NORTH AMERICAN BEES.

BY T. D. A. COCKERELL.

Osmia viridimicans n. sp.

♀. Length 12 mm., *brilliant peacock-green, the pubescence entirely black.* Head large, thorax ordinary, *abdomen somewhat elongate, the straight sides almost parallel, but slightly diverging to the fourth segment;* after which the sides rapidly converge, meeting at the apex at about a right angle. The light shines on the abdomen in such a way as to give the impression of deep sutures, which in fact do not exist. Punctuation ordinary, punctures of vertex and mesothorax distinct and separable. Basal area of mesothorax with its lower portion smooth and shining.

Lower part of face bluer than the vertex; cheeks broader than eyes; black pubescence of face tolerably abundant; front edge of clypeus black, straight, not produced at sides; mandibles 4-dentate; tegulæ green; wings smoky, hyaline, apical margin broadly darker, no dark streak in marginal cell; *first recurrent nervure reaching second submarginal cell a very short distance from its base, second* [redacted]

vertex. Facial triangle higher than broad; the face may be all blue, or green with the lower portion blue; the thin pubescence, even on the clypeus, is black and pale intermixed; cheeks about as broad as eyes; antennæ wholly dark; anterior edge of clypeus a little produced, black, broadly truncate, sometimes a little depressed in middle; mandibles with two large teeth, the third tooth, if present, is not visible when they are closed; *thorax with mixed black and pale hairs*, especially long on scutellum; basal area of metathorax minutely granular, not shining; tegulæ punctured, green with sometimes a purple spot; wings smoky; nervures black; first recurrent nervure joining second submarginal cell a little less than one-third from its base, second joining it a little less than one-fourth from the apex; legs green, tarsi black, hind tarsi sometimes submetallic on basal joint; dorsal surface of abdomen almost nude, the sparse short pubescence mixed black and pale; ventral scopa wholly black.

♂. Length 5½ to 8 mm., bright bottle-green, that is, a much yellower green than the ♀. Pubescence of head and thorax more copious, nowhere mixed with black; creamy white on clypeus, cheeks beneath, femora and lower part of thorax, pale ochreous on vertex and dorsum of thorax, especially scutellum; wings a little clearer; tarsi more distinctly metallic; the scanty pubescence of abdomen all light; sixth dorsal segment barely notched, seventh strongly emarginate; seventh ventral segment greenish-blue, large, its hind margin rounded, with pale pubescence.

Hab.—Olympia and Seattle, Wash. (T. Kincaid). The specimens can be separated into two general series, one larger, the other smaller and with more globose abdomen. After careful study, I fail to find specific characters separating these, but if it should be subsequently held that they are different, the type is to be considered the larger form. The females are, with one exception, of the larger size; the males are, with three exceptions, of the smaller; both forms were taken at the same time and locality.

The exact data are as follows:

Seattle: 1 ♀ May 14, 1897, on *Rubus ursinus;* 1 ♂ April 14, 1897, on sand bank; 1 ♂ April 18, 1897.

Olympia: 6 ♀, 3 June 1st, one June 2d, one June 21st, one July 1st. 13 ♂, one May 11th, two May 5th, one May 23rd, three May 25th, one May 28th, one June 13th, two April 25th, on *Fragaria;* two April 22d, on *Taraxacum.*

The female of *O. kincaidii* is easily separable from anything described, by its brilliant color, small size, and partly pale pubescence on thorax and face. The ♂ is not so easily separated, and should be compared with *exigua* from California, *bella* from Colorado, and *illinoensis* from Illinois. It agrees with Cresson's description of *exigua* except that none of the specimens are quite so small, and the tarsi are not testaceous, but black with a metallic tint, the last joint rufescent or wholly dark. From *bella* it will be known at once by the absence of black pubescence on the abdomen. From *illinoensis* it differs by the distinctly infuscated wings, the second submarginal cell not longer than first, the abdominal pubescence not subfuscous. It is quite possible that the present species may eventually prove to be a northern, larger and darker race of the Californian *exigua*, but it is desirable to distinguish it, whether as a species or as a race.

It is to be remarked that Provancher (Add. Faun. Hym., p. 330) records a male from Ottawa, attributed to *O. exigua*. I cannot think it likely that this identification is correct, but it is impossible to reach any definite conclusion, since Provancher's description appears to be simply a translation of Cresson's. It may be that he had *illinoensis* before him.

The body-colors of both sexes of *O. fulgida* (Colorado examples sent by Mr. Fox) agree with the colors of the corresponding sexes of *kincaidii*, but *fulgida*, while about as broad as *kincaidii*, is conspic-

Osmia calla n. sp.

♂. Length 8 to 9 mm., stoutly built, *Augochlora*-green. This almost exactly resembles the Olympia form of *bella*, but is, perhaps, a very slightly yellower-green, while *the dorsal pubescence of the abdomen is entirely white, and the second submarginal cell is not longer than the first on the cubital nervure.* The ocelli are a little further apart, and the teeth of the seventh abdominal segment seem to average longer. The pubescence of the inner side of the basal joints of the tarsi is fuscous, not black.

Other distinguishing features of *O. calla* are as follows: Pubescence throughout dull white, sometimes perceptibly tinged with ochraceous, *nowhere mixed with black.* Antennæ entirely black; clypeus ordinary. Punctures of mesothorax very close; *tegulæ wholly green;* basal area of metathorax ill-defined, minutely roughened, not shining; wings smoky-hyaline, first recurrent nervure joining second submarginal cell at about the end of the basal third, second not far from the apex; legs green, tarsi piceous; sixth abdominal segment notched feebly or quite distinctly, *but never entire;* second ventral segment large, purplish, rather densely fringed at apex with pale ochraceous-tinged pubescence.

Hab.—Olympia, Wash., 3 ♂, May 25th and June 17, 1894 (T. Kincaid). This has much the characters of ♂ *kincaidii*, but is conspicuously larger and bulkier than the largest males of that species. The antennæ in *kincaidii* are longer in proportion to the size of the head. While in color and length *O. calla* agrees with ♂ *fulgida* from Colorado, *calla* is much broader than *fulgida*, so that the two have quite a different appearance. The breadth of the abdomen in *calla* is 3 mm., in *fulgida* ♂ 2½.

Osmia bruneri n. sp.

♀. Length 9 mm., brilliant blue-green, the clypeus, legs and margins of abdominal segments shining purple. This may be only a race of *cobaltina*, from which it differs in being green instead of blue. The pubescence and ventral scopa are black, but dirty white hairs are intermixed slightly on the vertex, quite conspicuously on the dorsum of thorax, and also on the first abdominal segment. Compared with the Pasco *cobaltina*, the spurs of hind tibiæ are considerably larger and stouter, curved at the end, and the submarginal cells are both longer. The wings are strongly infuscated, and the second submarginal cell is, perhaps, a little longer than the first on the cubital nervure.

From the Colorado *O. fulgida*[1] and *viridis*, *O. bruneri* will be known by the green tegulæ, and the partly light pubescence of thorax. It may possibly be the unknown female of *O. bella*, but there is no way of determining whether this is the case at present.

Hab.—Colorado Springs, Colo. (L. Bruner, no. 19).

Osmia inurbana Cresson, 1878.

♂. 7 to 11 mm. long; *dark brassy-green. Sixth segment of abdomen distinctly notched.* Pubescence rather copious, tinged with ochreous on dorsum. 37 examples, Olympia and Seattle, Wash. (T. Kincaid). There is some variation, but they seem to be all one species; the extremes of size are connected by intermediates. The Seattle specimens were taken on April 17th and 18th, one in May; eight are from Seattle, the rest from Olympia. The Olympia dates run from April 20th to May 25th.[2] One was on *Fragaria* April 25th. A Colorado *inurbana*, sent by Mr. Fox, is like our medium sized examples.

Osmia odontogaster n. sp.

♂. Length 9 to 10 mm.; stoutly built, head of ordinary size, abdomen suboval; dark brassy-green, metathorax bluer; pubescence tolerably dense, ochraceous on head and thorax, very dense and cream color on clypeus, nowhere mixed with black, nigrofuscous on inner sides of basal joints of middle and hind tarsi, ochraceous on base and apex of abdomen, *short and fuscous on second, third and fourth* [redacted]

nervure; first recurrent nervure joining second submarginal cell nearly at the end of its basal third, second at the beginning of the apical fourth or a little beyond; legs black, basal joint of hind tarsus broad, truncate at the end; *sixth segment of abdomen with the margin entire*, seventh emarginate; second ventral segment with its hind margin fringed with long pale hairs, and *presenting medially a large and prominent tooth, directed backward, shaped like the terminal joint of a finger, but having a longitudinal groove.*

Hab.—Olympia, Wash., 5 ♂, May 10th and 25th, June 1st and 13, 1894 (T. Kincaid). This might be taken for *inurbana*, but its abdominal characters at once distinguish it.

Osmia nanula n. sp.

♀. Length 7 to 8 mm.; stoutly built, short, with the abdomen broad-oval. Color of head, thorax and abdomen *dark greenish-blue;* legs, mandibles and antennæ black. *Pubescence black, with ochraceous on sides of face, on occiput* about tubercles, slightly on mesothorax, *quite densely along hind border of scutellum, on sides of metathorax*, on lateral hind borders of the first three abdominal segments, especially the first, thinly along whole hind borders of four and five, very sparsely on surface of sixth, and on first four tarsi behind. The black hairs on the scutellum are considerably longer than the ochraceous ones, and are placed in front of them. Ventral scopa all black. Hairs on inner side of basal joint of hind tarsi dark fuscous. Pubescence of clypeus black, sparse, its anterior margin and the mandibles with some orange-rufous hairs. The ochraceous pubescence of the thorax, in fresh specimens, is quite bright, almost orange-rufous.

Punctuation ordinary, punctures of vertex and mesothorax large, very close, but not all confluent, the abdomen is quite shiny. Head fairly but not excessively large, clypeus ordinary, mandibles tridentate; tegulæ shining black, with a submetallic tinge in front: wings dusky, broad apical margin and upper half of marginal cell conspicuously darker: second submarginal cell noticeably shorter than first on cubital nervure; first recurrent nervure reaching second submarginal cell just before the end of its proximal third, second very near its tip.

Hab.—Seattle, Wash., 4 ♀, April 17th, May 11th and 19th (T. Kincaid); Olympia, Wash., 5 ♀, May 23rd, June 1st, 19th and 30th (T. Kincaid). A ♀ taken by Mr. Kincaid at Olympia,

Wash., differs by having a brassy-green abdomen; it appears to be only a variety of this species.

I have not described the ♂ of *O. nanula*, but I have before me a series of nine males, collected by Mr. Kincaid at Seattle and Olympia, which I believe belong here. They average slightly smaller than the females, and are of a brassy-green color. They might readily be confused with small examples of *inurbana*, but the *sixth abdominal segment is entire or very feebly notched.* The dorsal pubescence of the thorax and head is quite brightly colored, and not mixed with black. The smaller size and the absence of the ventral tooth at once separate them from *odontogaster*.

Osmia tristella n. sp.

♀. Length 7 to 8 mm., of ordinary build, the abdomen somewhat longer than in *O. nanula*. Head, thorax and abdomen *dark indigo blue;* legs, mandibles and antennæ black. Head of ordinary size, not so large as in *nanula*. *Pubescence black*, not dense, long on head and thorax, *white just behind wings and at sides of first abdominal segment subbasally;* there is also some obscure white or whitish pile on the last dorsal segment of the abdomen. *The pubescence of the face, vertex, thoracic dorsum and ventral scopa is wholly black.* The abdominal segments between the first and last are shining, and present some short pile, wholly black except for an occasional short pale hair. The pubescence of the legs is all black.

[redacted]

ventral scopa, black, *but there are some shining pale hairs along the hind margin of the scutellum, and sparsely on the abdominal dorsum;* the extreme apex of the abdomen, the anterior edge of the clypeus, and the outer surface of the mandibles exhibit some orange pile; the pubescence of the tarsi, especially the anterior ones, is also more or less of a pale orange tint. *The hairs of the face and vertex are wholly black, and the tuft just behind the wings is black.* Punctuation ordinary, not quite so dense as in some related species; ocelli light yellowish, clypeus ordinary; tegulæ shining black; wings smoky; second submarginal cell perhaps a very little longer than first on cubital nervure; first recurrent nervure reaching second submarginal cell slightly before the end of its basal third, second very near its end.

Hab.—Olympia, Wash., May 23, 1894 (T. Kincaid). Resembles *tristella*, but easily known by the characters italicized.

Osmia trevoris n. sp.

♀. Length 8 mm., stoutly built, head quite large, abdomen short and broad. The thorax is by no means so broad as in *cyanella*. Head, thorax, and abdomen *very dark blue, the two latter a slightly greenish-blue*, yet bluer than in *nanula;* legs, mandibles and antennæ black. Pubescence of head black, except some fulvous on occiput, hairs of face long, *all black;* pubescence of pleura black, *of thoracic dorsum moderately dense, and orange-fulvous*, with a few dark hairs intermixed, not readily noticed; *tuft behind wings orange-fulvous;* hairs of femora and tibiæ short and black, or tarsi dull fulvous; dorsal pubescence of the abdomen entirely black, except a thin, pale fulvous fringe along the hind margins of the segments, only noticed in certain lights; ventral scopa all black. Punctuation ordinary, punctures of vertex and mesothorax close but separable. Clypeus ordinary; tegulæ black; wings dusky hyaline, with the broad outer margin and the upper part of the marginal cell conspicuously darker; second submarginal cell a little longer than first on cubital nervure; first recurrent nervure joining second submarginal cell at about the end of its basal third, second a very short distance before its tip.

Hab.—Seattle, Wash., May 19, 1896 (Trevor Kincaid). This is closely related to *O. nanula*, but it is somewhat broader, with a larger head, and lacks the pale pubescence at sides of face, while the pubescence of the thoracic dorsum is dense and much more highly colored; the abdomen, also, is less globose. *O. trevoris* re-

sembles a good deal in color and form *O. cerasi* from New Mexico, but it is smaller than that; the thoracic pubescence is by no means so bright, and the dorsal abdominal pubescence of *cerasi* is entirely black, except on the first segment, where it is pale fulvous, usually mixed with black.

Osmia propinqua Cresson, 1864.

I have before me 8 females, sent by Mr. T. Kincaid; two from Seattle, Wash., May 11 and 14, 1897, on *Rubus ursinus;* one from Comas I., Wash., June 18, 1896, collected by N. L. Gardner; five from Olympia, Wash., May 9 and 23, and June 1 and 2.

Osmia subornata n. sp.

♀. Length 14 mm., stoutly built, rather shiny, *pure black;* head large, subquadrate, abdomen short and broad; *pubescence of face and vertex entirely black, with sometimes a few pale hairs about the insertion of the antennæ*, of cheeks and pleura dark griseofuscous to almost black, of *thoracic dorsum black on disc, with a pale band before and behind,* the anterior band not very distinct, reaching from tubercle to tubercle, the posterior occupying the scutellum, and very distinct, but having black hairs intermixed. The color of these hair-bands is very pale ochraceous. A tuft of pale ochraceous hairs behind the wings. Pubescence of legs entirely black, or a little fuscous on anterior basis. Pubescence of abdominal dorsum black, some rather obscure pale hairs on sides of first segment, and the [redacted]

thorax. *Pubescence of head entirely black, except a yellowish-white fringe on occipital margin; of thoracic dorsum cream-colored, with longer black hairs intermixed*; of sides of thorax black; a cream-colored tuft on tubercles and one behind wings, but the hairs of sides of metathorax below that black. Pubescence of legs black, shining fuscous on inner side of anterior tarsi. Pubescence of first abdominal segment cream-color, not mixed with black, *of the remaining segments black*, scopa wholly black. Tegulæ black. Wings dull hyaline, with the broad apical margin and the marginal cell conspicuously darkened. Second submarginal cell a little longer than first on cubital nervure; first recurrent nervure joining second submarginal cell a little before the end of the basal third, second at the beginning of the apical sixth. Punctuation strong and quite dense on head and thorax; sparse on abdomen. *Anterior margin of clypeus truncate, crenulated or ribbed, the sides of the truncation sloping away,* the angle at the corners a very obtuse one. *Apical tooth of mandibles very long,* curved. *Spurs of hind tibiæ rather slender and straight.*

Hab.—Pasco, Wash., May 25, 1896 (T. Kincaid). Closely allied to several species. From *subornata* it may be known by the somewhat larger size, the blue tint of the abdomen, the long apical tooth of mandibles, the straight and more slender spurs of hind tibiæ, the absence of the black dorsal pubescence of the thorax, etc. From *bucephala* and *megacephala* by the smaller head, entirely black pubescence of face, etc.: from *nigrifrons* by the larger size. It agrees very nearly with Cresson's description of *nigrifrons*, and may represent a northwestern subspecies of that insect.

Osmia grandior n. sp.

♀. Length about 16 mm. Closely resembles *O. pascoensis* in all respects but the following: *Head smaller; clypeus dull and roughened* (in *pascoensis* shiny, with well separated punctures); apical tooth of mandibles shorter; *two conspicuous brushes of orange hair beneath the margin of the clypeus;* vertex with smaller and closer punctures; *vertex and whole of thoracic dorsum covered with pale fulvous hair, rather dense and not mixed with black; brush of hairs behind wings black;* metathorax tinged with bluish; pubescence of first abdominal segment black with pale hairs intermixed; appressed pubescence of last segment fuscous; *pubescence of first four tarsi shining reddish fulvous;* marginal cell and second submarginal

shorter; abdomen somewhat longer. The clypeus is quite ordinary, its margin straight.

Hab.—Olympia, Wash., May 10, 1894 (T. Kincaid). This would be easily confused with *pascoensis*, if attention were not paid to the details italicized. It is apparently the representative, in the northwest, of the Colorado *juxta* and *longula*. The blue tint and the color of the thoracic pubescence at once separates it from *subornata*.

Osmia subpurpurea n. sp.

♀. Length about 14 mm., relatively slender, *dark steel blue*, the legs, antennæ and mandibles black. Head subquadrate, rather large, at least as broad as the thorax. *Pubescence of face dull white with a slight yellow tinge, with numerous black hairs intermixed*; of cheeks pale; of vertex long, thin and mostly black; of thoracic dorsum white with a slightly yellowish tinge, with longer black hairs intermixed; of pleura sparse, dull white; of sides of metathorax copious, white; of legs short and black, with some dull white on femora behind, and dark fuscous on tarsi; of first abdominal segment dull white and quite abundant; of remaining segments very short, dark, hardly noticeable, except that *the hind margins of segments 2 to 5 present each a thin and narrow, but very visible, white hair-band*, and the short pile of the apical segment is pale. Ventral scopa entirely black. Punctuation of vertex strong, but not so close as to hide the shining surface; of mesothorax very close, the surface appearing roughened, dull and dark; of abdomen minute and sparse enough to leave a very shiny surface. Basal area of metathorax [redacted]

blue, with a greenish tint on the dorsum of thorax and parts of the abdomen; legs, mandibles and antennæ black. Pubescence rather thin, *entirely black except a very few scattered pale hairs near the tubercles, on scutellum, and sides of metathorax, and rather more on first abdominal segment.* Ventral scopa entirely black. Punctuation ordinary, punctures of mesothorax dense but not confluent, of abdomen rather close but leaving a shining surface; median line of mesothorax distinct, basal area of metathorax moderately shiny; antennæ short; clypeus ordinary, *anterior margin entire;* apical tooth of mandibles very short; tegulæ black; wings smoky, paler along the nervures; second submarginal cell about as long as first on cubital nervure; first recurrent nervure reaching second submarginal cell a little before the end of its basal third, second just after the beginning of its apical sixth.

Hab.—Olympia, Wash., July 4, 1896 (T. Kincaid). Seems near to *O. brevis*, but differs in the color of the pubescence, larger size, etc.

Osmia brevis Cress.

An authentic Colo. ♀ specimen, sent by Mr. Fox, does not have the head as large as one would imagine from Cresson's description. The pubescence of the pleura is brownish-black. The abdomen is of a fine dark shining indigo-blue. The second submarginal cell is longer than the first on the cubital nervure; the first recurrent nervure joins the second submarginal cell somewhat before the end of its basal third, the second quite near its tip. At Pasco, Wash., May 25, 1896, Mr. T. Kincaid took a couple of ♀, agreeing with the Colorado insect, though having the second submarginal cell a little shorter. At Olympia, Wash., June 24, July 7, etc., Mr. Kincaid has taken in numbers a species like *brevis*, but with a more convex, very shiny, dark prussian green abdomen; I supposed it to be a different species, but leave it for the present with this allusion. It is quite possibly the ♀ of *inurbana* or *odontogaster*.

At Pasco, May 25, 1896, Mr. Kincaid also took a couple of males which it seems safe to refer to *brevis*, although the ♂ of that insect has not been described. The abdomen is indigo-blue like the ♀, but narrow and more shiny; antennæ wholly black, reaching about to scutellum; pubescence of face, vertex and thoracic dorsum yellowish-white, rather copious; of cheeks, pleura and sides of metathorax black; wings quite hyaline, except a slight stain in the upper part of the marginal cell; dorsal pubescence of abdomen all

black except on first segment; ventral pubescence black, a pale median patch just beyond apex of second segment; sixth dorsal segment entire. This ♂ is like *O. montana* from Pike's Peak, but is separated by the entire sixth segment of abdomen.

Osmia proxima Cresson.

This is considered to be the ♂ of *atriventris*; it was described from Maine and British America. At Olympia, Wash., June 24, 1895, Mr. T. Kincaid took a ♂ which is evidently conspecific with an authentic Canadian *proxima* sent by Mr. Fox. This insect will be recognized by its small size, large head, short subglobose thorax and abdomen, and shining dark blue-green color. The hind margins of the abdominal segments are inclined to be edged with testaceous—in the Olympia insect this is quite conspicuous. The antennæ are long, and the flagellum is more or less brownish or rufescent beneath. The tegulæ are greenish in front. The wings are hyaline. Sixth abdominal segment notched.

Osmia faceta Cresson.

♀. One collected at Olympia, Wash., June 2, by Mr. T. Kincaid, agrees with an authentic Canadian example lent by Mr. Fox. It is a little greener than that from Canada, but the specific characters are the same. It is especially to be noted that while the ventral scopa is black, there is white hair on the extreme lateral margin of the abdomen, which may run along the margins of the dorsal seg-

[redacted]

B. Pubescence of pleura black.

a. Pubescence of scutellum black, with a few pale hairs intermixed, of sides of metathorax black ; head strongly blue,

atrocyanea, Ckll.

b. Pubescence of scutellum light, with, at most, a few dark hairs intermixed ; head less blue, clypeus black or almost so,

nigrifrons, Cr.

(An authentic specimen from Colorado, sent me by Mr. Fox ; one from Colorado Springs, Colo., sent by Prof. L. Bruner ; one from Olympia, Wash., May 25, sent by Mr. T. Kincaid.)

Synhalonia edwardsii (Cresson, 1878).

This is evidently common at Olympia, Wash., and is sent in numbers by Mr. T. Kincaid. Cresson describes only the ♂ ; the ♀ is from 14 to 16 mm. long, and differs from that of *S. frater* by its mouse-colored thoracic pubescence and by the abdominal bands, which, though very white, are reduced to two, on the third and fourth segments, that on the third interrupted in the middle. The second segment has a small white patch on each extreme side. A Seattle ♀ has the thoracic pubescence ochraceous as in *frater*, but the abdominal characters remain quite distinct. One Olympia ♀ has an interrupted band on the second segment. Within what must be considered the specific limits of *S. edwardsii* there are, in Washington State, two distinct types :—

(a.) Race *latior*. ♂. Facial quadrangle not far from a square, sides of the clypeal yellow, gradually sloping above, distance between the yellow and the eyes quite considerable. Olympia and Seattle.

(b.) Race *angustior*. ♂. Face conspicuously longer than broad. Sides of clypeal yellow, above squarely notched, distance between the yellow and the eyes extremely small ; pubescence somewhat paler. ♀. Smaller, with paler pubescence, abdomen with the white bands on the fourth and fifth (instead of third and fourth) segments, that on the fifth fuscous in the middle, but brilliant white at the sides, a white mark on each side of third, apical segment white at sides. Wings clearer. Pasco. The exact data are as follows :—

Race *latior*. Olympia, 18 ♂, April 24, May 2, 10, 11, 17, 21, 23, 25 ; June 5 ; 19 ♀, June 1, 5, 11, 18, 19, 21, 24, 25, 29, July 4. Seattle, 3 ♂, April 17, May 3 ; 2 ♀, both May 19 (T. Kincaid). Two Olympian ♀s are from *Lupinus*.

Race *angustior*. Pasco, 5 ♂, 2 ♀, all taken May 25, 1896 (T. Kincaid).

Synhalonia lycii n. sp.

♀. Length 13 to 14½ mm.; general form, size and structure of *S. frater*, which might be readily confused with it on superficial examination. On comparing *lycii* with an Illinois example of *frater* received from Mr. Robertson, the following differences are at once apparent:—

S. frater ♀.	*S. lycii* ♀.
Segments 2–5 of abdomen with distinct light bands; apex with light brown pubescence.	Segments 2 and 3 of abdomen with light bands; 4 and 5 sooty black, without light bands, or at most a very narrow apical gray band on 4; apex with black pubescence.
Ventral surface of abdomen with light pubescence.	Ventral surface of abdomen with black pubescence.
Wings noticeably brownish.	Wings clear.

The above are conspicuous and constant distinctions: yet the head, thorax and legs of the two insects, with their pubescence, are virtually the same.

Hab.—*S. lycii* occurs in the Mesilla Valley, New Mexico, near

pes to be conspecific. At all events, I think, one may say, that the ♂ of *scitulus* is either *pictipes* or closely similar to it.

A ♀ from Colorado (Baker 1,599=Fort Collins, Aug. 15, 1895, on *Solidago canadensis*) has the clypeus entirely black.

Calliopsis australior n. sp.

The ♀ of this so greatly resembles *scitulus* in every respect that it was long held to be a variety of it, and I only now separate it on observing that the differential characters are constant. The band on the third abdominal segment, usually entire in *scitulus*, is *always interrupted*, often quite widely; the band on the fourth segment is usually entire, being the only entire band; *the fifth segment is black, with neither band nor spots; the lateral face-marks are always much broader and shorter than in scitulus; the clypeus always has a pale stripe down the middle;* otherwise the two insects are about the same. It is to be remarked that *australior* partakes of the characters of the Californian *C. edwardsii*, which has the longitudinal clypeal mark but not the lateral marks on the clypeus, which are common to *australior* and *scitulus*. *C. edwardsii* is also a larger insect than *scitulus*, whereas *australior* is of the same size.

The ♀ of *australior* I found in numbers visiting the flowers of *Cleome serrulata* at Albuquerque, N. M., Aug. 16; I also found it on the sand hills at Mesilla, N. M., May 29, numerously visiting the flowers of *Dithyrea wislizeni* Engelm. It also comes from Colorado, collected by Prof. C. F. Baker (No. 1,592=Fort Collins, Aug. 8, 1895, on *Cleome*).

The Colorado form has the abdominal markings more yellow than that from New Mexico.

I am uncertain about the ♂ of *australior*, but Baker's 1,591 (Fort Collins, Aug. 8, 1895, on *Solidago canadensis*) may belong there. It has the first joint of hind tarsus yellow, not greatly broadened, and with no conspicuous tuft of hairs at the tip. The face is all white below the level of the antennæ, except a couple of black dots on clypeus, and one at apex of each dog-ear mark. The postscutellum and a transverse band on the scutellum are white. I took a closely similar ♂ at El Paso, Texas, May 13, 1897, three specimens. It has the face more narrowed below, and the abdominal markings more reduced than in the Colorado insect. It was flying round *Baccharis*.

Calliopsis personatus n. sp.

♀. Length 8 mm. This also is a sort of modified *scitulus*, but the modification is in a different direction. The most obvious char-

acter is that *the face is entirely black,* although there remains a white spot at the base of the mandibles. The abdomen has a spot on each side of the first two segments, a broadly interrupted band on the third, and an almost continuous one on the fourth, these markings being white. The fifth segment, as in *australior,* has neither band nor spots; the apical pubescence is entirely white. For the rest, the characters are practically as in *scitulus.*

Hab.—Pasco, Wash., May 25, 1896 (T. Kincaid).

Calliopsis clypeatus Cresson, 1878.

Cresson had only a single ♂. Prof. C. F. Baker has taken both sexes in Colorado (No. 1,581, on Laramie River, Larimer Co., 8,500 ft., July 19, 1895). The ♀ is like the ♂, except that the face is wholly dark: the antennæ shorter, with the flagellum, after the third joint, dull ferruginous beneath; the abdomen broader, the apical portion with white pubescence, and the extreme apex with a broad, dense, ochreous brush.

Calliopsis boylei Ckll., 1896.

This is not rare at Santa Fé, New Mexico. It is also found in Colorado, a specimen before me was collected by Prof. C. F. Baker (No. 1,600). The Colorado form has a yellow line on the scape, and a study of it leads me to believe that *C. boylei* is probably only a variety of *C. ornatipes* (Cress., 1872). In the typical *boylei* from Sta. Fé, the scape is entirely black.

[redacted]

Hab.—Santa Fé, N. M.; females; July 27, 1895, at flowers of *Sphæralcea angustifolia*; Aug. 5, Aug. 14, Aug. 14, July 25 on *Sphæralcea angustifolia*; Aug. 19, 1894. Males: Aug., 1894; July 27, at flowers of *Sphæralcea angustifolia*; Aug. 5, July 30, burrowing in damp soil, I saw it enter, and dug it out from end of burrow.

Andrena kincaidii n. sp.

♀ 14 mm. long, black; head and thorax with short, dense, ochraceous pubescence; abdominal segments 2 to 4 with more or less broadly interrupted apical bands of pale ochraceous pubescence; apex densely fringed with orange-rufous pubescence. Femora black, *tibiæ and tarsi wholly ferruginous.* Process of labrum truncate, subemarginate. Clypeus with rather large, not very dense punctures, and a median smooth longitudinal ridge or line. Mesothorax and scutellum distinctly but not very densely punctured, the punctures unevenly distributed; basal area of metathorax rugose, ill-defined; *abdomen distinctly and quite closely, though not deeply, punctured.* Antennæ wholly black. Tegulæ rather dark testaceous. Wings strongly tinged with yellowish-ferruginous, the apical portion grayish, and the *apex conspicuously blackish;* nervures and stigma ferruginous. Mandibles notched at end.

♂. About 11 mm. long, more slender, pubescence paler, sometimes becoming whitish, no bands on abdomen; *clypeus lemon-yellow with two black spots;* antennæ wholly dark; tibiæ and tarsi all ferruginous as in the ♀. Hind-margins of abdominal segments becoming testaceous.

Hab.—Olympia, Wash., very numerous specimens of both sexes sent by Mr. Kincaid. The dates for the females run from May 9 to June 29, for the males from May 25 to June 12. It is a very distinct species, at once known by the characters italicized. Rarely the ♀ exhibits a yellow spot on the clypeus, in the median line not far from the anterior margin.

Andrena saliciflaris n. sp.

♀. About 11 mm. long, black, the pubescence brownish-ochraceous. Head ordinary, face broad, facial quadrangle broader than long, pubescence of face fairly abundant; clypeus shining, but strongly and rather closely punctured, with a rather strawberry-like surface; basal process of labrum rounded; antennæ black; vertex with close shallow punctures, the surface minutely roughened; mesothorax dull, with tolerably close strong and very large punctures, median and parapoidal grooves distinct; scutellum with large

punctures, becoming smaller and very dense on its hindmost portion; enclosure of metathorax ill-defined, irregularly longitudinally wrinkled; pleura strongly and closely punctured; tegulæ piceous; wings smoky-hyaline; nervures and stigma very dark brown or piceous; legs with brownish-ochraceous pubescence; basal joints of middle and hind tarsi rather broad; *abdomen strongly punctured*, rather shiny, practically naked, except for some thin pubescence at base of first segment, *lateral grayish-white patches on hind margins of segments 2 to 4 representing very broadly interrupted bands, and dense reddish-orange pubescence at the apex.* Venter with three thin hair bands.

♂. Length 9 mm.; pubescence more abundant and *rufous throughout*, of quite a bright tint. Face an antennæ wholly dark; band on fourth segment of abdomen entire, but very thin in the middle, and, like the other abdominal markings, orange-rufous. Abdomen not so closely or deeply punctured.

Hab.—Olympia, Wash. (T. Kincaid). The ♀ May 9th; the ♂ April 4th, at willow blossom. In some respects this resembles *A. pruni* Rob., but it is quite distinct.

Ceratina nanula n. sp.

♂. Length 4½ mm., shining, very dark bluish-green, brassy-green on the mesothorax. Legs concolorous except the tarsi, which are dark brownish, the small joints of anterior tarsi dull ferruginous.

black; the wings somewhat dusky; the hind femora more produced below, the angle resulting less than a right angle.

Hab.—Olympia, Wash., May 10th; also April 25th, at *Fragaria* (T. Kincaid). I have also before me a couple from Seattle, Wash., May 13th, from Mr. Dunning, marked "Lot 214."

The two species described above differ at once from *dupla* and *tejonensis* in the ♂, by having the abdomen terminated by a point; the last ventral segment in both *tejonensis* and *dupla* is broadly rounded at the end. At one time I thought *nanula* might be *C. strenua* Smith, but that cannot be, as Smith expressly states of *strenua*, "seventh segment rounded at the apex."

As regards the females, the distinctions are not so obvious. I have what I suppose to be females of *nanula* from Juarez, Las Cruces and Santa Fé, New Mexico; but except in being smoother and more shining (like the ♂) they do not appreciably differ from *dupla*, and it may well be that some of the larger examples (8½ mm. long, Sta. Fé, July) belong really to *dupla*, though of this I cannot be sure until ♂ *dupla* has been caught at Sta. Fé.

The ♀ of *C. submaritina*, which Mr. Kincaid took in some numbers at Olympia, Wash., differs at once from the supposed ♀ of *nanula* in having the clypeus *entirely dark*, or at most with a very small and obscure spot. *C. acantha* Prov., from Los Angeles, Calif., is described only from the ♀; it is too small for *submaritima*, its clypeus is said to have a median testaceous line.

Perdita sidæ n. sp.

♂. Length 4⅔ to 5⅓ mm. Head and thorax very dark metallic blue, obscurer and more inclined to greenish on mesothorax and scutellum, shining; the white pubescence moderately abundant. *Head large, subquadrate, broader than thorax, and considerably broader than long;* cheeks unarmed, but occasionally produced below into a prominent angle or incipient tooth. Clypeus broad and low, of the Panama-hat type; mandibles, except their dark tips, labrum, and *face up to the level of antennæ light yellow;* supraclypeal yellow area broader than long; upper limit of the yellow immediately lateral to the antennæ not as high as the top of the supraclypeal mark, but only reaching to the lower level of the antennal sockets, but rising as it approaches the orbit, to end at an angle of about 45° slightly above the upper level of the antennal socket. *Antennæ wholly deep orange;* ocelli in a curve. Front above level of antennæ with tolerably sparse but very distinct punc-

tures; vertex shining, microscopically sculptured with very sparse punctures. Mesothorax sparsely punctured; tubercles, and hind border of prothorax, more or less pale dull yellowish; sometimes this is hardly noticeable. Tegulæ hyaline with a blackish spot; wings hyaline, *stigma and nervures white;* stigma long and well-formed, marginal cell with its post-stigmatal portion longest, squarely truncate at end, with a very fine appendicular nervure. Second submarginal high, narrowed rather more than half to marginal; third discoidal distinct. *Anterior tibiæ and tarsi wholly lemon-yellow,* anterior femora yellow suffused with brown; middle tarsi whitish; middle and hind femora and tibiæ, and hind tarsi, piceous; the middle femora in front, and the middle and hind knees, dull yellowish or whitish; middle femora angled below. *Abdomen pale brown,* the hind margins of the segments hyaline, the venter dull brownish-orange.

♀. Same size and form. *Face wholly dark, except that the upper edge of the clypeus is dull whitish,* this coloration very inconspicuous. Head not so large, transversely oval; antennæ shorter. *Scape black, flagellum dull brownish-orange, infuscated at the base.* Legs piceous, anterior tibiæ and tarsi obscurely dull yellow in front. *Abdomen piceous above and below, without markings.*

Hab.—Mesilla, New Mexico, June 7th and 9, 1897, on flowers of *Sida hederacea.* They fly actively about the flowers, and in dull [redacted]

Hab.—Mesilla Valley, close to the Agricultural College, on flowers of *Baileya multiradiata*, May 21, 1897, both sexes taken. The ♂ I have described previously; the species is quite remarkable for having more light color on the face in the ♀ than in the ♂. The ♀ of *callicerata* closely resembles the ♂ of *albovittata*, but differs at once by the color of the antennæ, the yellow anterior tibiæ, etc.; the face-marks of the two are almost exactly alike.

Perdita larreæ Ckll. var. *modesta*, n. var.

♂. Like the type, but head not nearly so large, being only about as big as the thorax.

Hab.—Mesilla Valley, close to the Agricultural College, May 21, 1897, two at *Larrea*.

Centris morsei n. sp.

♂. Length 21 mm., stoutly built, black, with pale ochraceous pubescence, very dense on thorax. Clypeus bright lemon-yellow, with anterior margin rufous; labrum yellow; mandibles dark rufous with black tips; scape without any yellow; eyes sage-green, suffused with crimson at the extreme base; facial quadrangle longer than broad, but of the broad type; wings dusky hyaline; tegulæ cream-color; first abdominal segment with abundant pale pubescence; remaining dorsal segments uniformly and completely delicately pruinose-pubescent, producing a grayish appearance; apical margins of segments colorless or rather whitish-hyaline, extreme base of third segment, and of second segment at sides ferruginous, this ferruginous portion being overlapped by the white margin of the segment before. Venter with dense yellowish-white hairs; apex with pale shining hairs, genitalia ferruginous.

Compared with the ♂ of *C. cæsalpiniæ*, which it most resembles, *C. morsei* is considerably larger, the thoracic pubescence inclines more to mouse color, and the pruinose-pubescent abdomen with its two more or less defined reddish bands is very different. In *morsei* the hind tarsi have a black brush on the inner side, but the abundant long pubescence is all ochraceous, not at all fuscous or blackish. The long hairs of the anterior tarsi are blackish, though shining, and appearing golden in certain lights.

Hab.—Mesilla, New Mexico, bed of the Rio Grande, June 28, 1897. Taken by Mr. A. P. Morse.

OCTOBER 5.

The President, SAMUEL G. DIXON, M. D., in the Chair.

Thirty persons present.

A paper entitled "Volcanic Rocks of Mesozoic Age in Pennsylvania," by Edward Goldsmith, was presented for publication.

OCTOBER 12.

MR. CHARLES MORRIS in the Chair.

Nineteen persons present.

OCTOBER 19.

The President, SAMUEL G. DIXON, M. D., in the Chair.

Papers under the following titles were presented for publication :—

"A Revision of the Genus Synidotea," by James E. Benedict.

"Reptiles from Sonora, Sinaloa and Jalisco, Mexico, with description of a new species of Sceloporus," by John Van Denburgh.

"Contributions to the Herpetology of San Paolo, Brazil, I," by

NEW ACHATINIDÆ AND HELICIDÆ FROM SOMALILAND.

BY HENRY A. PILSBRY.

The following descriptions are based upon material collected by Dr. A. Donaldson Smith. Other mollusks presented to the Academy of Natural Sciences of Philadelphia by the same intreped explorer belong to species already known. They represent so small a fragment of the fauna of this interesting part of Africa that their enumeration here may be dispensed with.

Achatina chrysoleuca n. sp.

Shell ovate, with conic spire, in general contour like *A. variegata.* Solid and strong, though not very thick. *White*, with a thin golden-brown cuticle, which is deciduous over the greater part of the shell, remaining behind the aperture and in the depressions between longitudinal plications elsewhere; later 1½ whorls immaculate, the next earlier with spaced, somewhat zig-zag and rather broad brown streaks, the next earlier narrowly streaked, the streaks straight. Whorls of the spire soiled white. Whorls 6½ (the apical whorls truncated, perhaps 1 or 1½ whorls being thereby lost), moderately convex, the last quite convex. Surface shining, finely decussated on the spire, the sculpture hardly visible to the naked eye, and gradually becoming obsolete, the spirals lost on the latter 1½ whorls, which are somewhat coarsely plicatulate. Sutures even above, weakly and irregularly serrate below. Aperture a little exceeding half the length of the shell, pure white within, subvertical, acuminate above, deeply excised by the body-wall; outer lip rather regularly arcuate, but less curved above, simple; columella short, cylindric, very deeply concave on the front and the side toward aperture, abruptly truncated at base, delicate flesh-tinted; parietal wall with a thin, transparent varnish. Alt. 105, diam. 58 mm. Longest axis of aperture 60, greatest width of cavity 33 mm.

Tulu Didirko, in about lat. 4° 4′ N., lon. 39° 36′ E., at 3,580 ft. alt. (Dr. A. Donaldson Smith, March 27, 1895).

Type is No. 68,113, coll. A. N. S. P. It is an ivory-white shell, with some inconspicuous marking on the spire. The cuticle is largely deciduous. Nothing very nearly allied seems to be described from this portion of the continent.

Limicolaria Donaldsoni n. sp.

Shell narrowly perforate, oblong-ovate, rather thin. Spire terminating in a *very obtuse rounded apex.* Whorls slightly over 6, *quite convex,* separated by deep sutures. Surface shining, finely striated longitudinally, the striæ cut into oblong granules by decussating spiral impressed lines, which become subobsolete on the last whorl except below the suture where they persist, although weaker. Aperture ovate, a little less than half the length of the shell, bluish-white within; outer lip thin and sharp; columella straight in the middle and above, slightly concave below, the columellar lip reflexed over the umbilicus. Color white under a very thin yellow cuticle, with faint narrow, sinuous and interrupted brown streaks. Alt. 39, diam. 20½ mm.; alt. of aperture 17, width of cavity in the middle 10 mm.

The Haud (Dr. A. Donaldson Smith, July 25, 1894).

Type is No. 68,114, coll. Acad. Nat. Sci. Phila. Of described species, *L. Beccarii* Morel. seems to be nearest to this one; but that has the spire longer and less obtuse at apex, a stronger color-pattern, etc. *L. Donaldsoni* is remarkable for the unusual convexity of the whorls. None of the very numerous species described during the last few years seem near to this form.

Limicolaria Vanattai n. sp.

Shell very narrowly perforate, oblong-conic, compact, thin, white under a thin yellow cuticle, variegated with many longitudinal, [redacted]

the left as it approaches the base; the reflexed edge adnate nearly to base, where it is free, leaving a small umbilical perforation. Length 56, diam. 26; alt. of aperture 25 mm.

Sheikh Husein, lat. 7° 43′ 32″ N., lon. 40° 44′ 30″ E., (Dr. A. Donaldson Smith, Sept. 21, 1894).

Somewhat like *L. turris* Pfr., but the columella is distinctly convex instead of gently concave, and the apex is decidedly more obtuse. It is also a smaller, less conic shell. The spire is longer than in *L. Rüppelliana* Pfr. as figured by Jickeli. The narrow, straight, not branching, color streaks are also characteristic. It is dedicated to Mr. E. G. Vanatta, who kindly assisted me in examining the literature of *Achatinidæ* for the species herein described.

Helicella (Lejeania) chionobasis n. sp.

Shell very narrowly umbilicate, thick lens-shaped, low-conoid above, flattened-convex beneath; the periphery angular at first, becoming rounded; rather thin but moderately solid, and slightly shining. *Conspicuously bicolored*, the *base being opaque white* as in Xerophiles generally, the *top rust-brown* with numerous irregular, arcuate whitish streaks, the *apex and several earlier whorls glossy-black.*

Sculpture of irregular, low wrinkles of growth, with extremely fine arcuate striæ also above; on the base *very minute incised circular striæ* are visible under the lens in addition to the wrinkles. Whorls nearly 6½, slowly increasing, slightly convex, a distinctly defined whitish cord margining the sutures above, produced by the keel of the whorls. Aperture mainly basal, lunate, moderately oblique, bicolored within; peristome simple, suddenly dilated at the columellar insertion, partly covering the narrow umbilicus. Alt. 13, greatest diameter 19·5, least 18 mm.

The Haud (Dr. A. Donaldson Smith, July 25, 1894).

The italicized clauses in the above description sufficiently indicate the more conspicuous features of this form, which is apparently different from any member of the group *Lejeania* known to me.

The permanence of the name *Helicella* for the group of Xerophiles depends upon the date of publication of Férussac's Prodrome, which is still in doubt. It may prove later than *Jacosta* of Gray, which would then assume the generic rôle. This is a mere question of names, however. The limits and characters of the group I have been able to define with considerable exactness, thanks to the previous work of Schmidt, Moquin-Tandon, von Ihering and others.

NEW AUSTRALIAN MOLLUSKS.

BY HENRY A. PILSBRY.

The forms described below occurred in a recent sending received from Dr. J. C. Cox, consisting mainly of marine mollusks he had collected at Eden, on the coast of New South Wales, a catalogue of which will probably be published by him elsewhere. In the present scattered condition of the literature of Australian mollusks, only omniscience can always escape the danger of overlooking some description; but reasonable care is believed to have been taken in dealing with the following.

Genus TATEA Tenison-Woods.

The relationships of *Tatea* seem to require examination: In the Manuals of Fischer and Tryon it is placed under *Jeffreysia* as a subgenus; but it differs radically from this group in dentition and operculum, and is also unlike it in shell characters. The *Rissoina* group is that to which *Tatea* seems allied by its operculum; and *Eatoniella* Dall, with species in Kerguelen Island, South Georgia and New Zealand, would apparently be the most nearly allied [redacted]

the text on p. 94, there are three denticles on this tooth, but the description on p. 96 gives five denticles. The outer uncinus has seven denticles. The denticle formula of what Martens and Pfeffer identify as *Eatoniella kerguelenensis* is, therefore, $\frac{7}{1\text{-}1\ (?)}$, 5, 3 (?), 7.

In *Dardania* Hutton,[1] which, so far as shell, operculum and radula go, is identical with *Eatoniella*, the dentition as figured by Hutton agrees in essentials with that genus. Hutton's figure is rather diagrammatic. It shows no basal denticles, the formula being $\frac{5}{0\text{-}0}$, 6, 3, 5 (?). This seems to agree essentially with *Eatoniella*, especially in the important and unusual character of the inner marginal tooth, the cusp of which is remarkable for the small number and large size of its denticles. The omission of basal denticles may be an oversight.

The inclusion of *Dardania* in *Eatoniella* seems from the data at hand to be necessary.

Now, in *Tatea*, the radula (Pl. IX, fig. 8) is unequivocally Hydrobioid. Judging from it alone, if one were to ignore the shell and operculum, it would be pronounced a *Potamopyrgus*. It differs in very important particulars from that of *Eatoniella*. The rachidian tooth shows several well marked basal denticles *inserted well above the basal margin of the tooth*, as in the freshwater genera. The lateral is as usual above, and has the tongue-like process below, noticed in many non-marine forms. The inner uncinus has the scythe-like form usual in *Hydrobia* and its allies, with 15 to 20 minute denticles on the long cusp. The outer uncinus has still finer denticulation. It will be seen that both the median and the inner marginal teeth are quite different from the corresponding teeth of *Eatoniella*, and altogether like those of *Potamopyrgus* and its allies.

From these characters we would advocate the removal of *Tatea* from the subfamily *Rissoininæ*, and install it in the *Amnicolidæ* (*Hydrobiidæ* of Fischer), notwithstanding its aberrant operculum. The union of *Tatea* with *Eatoniella*, which some authors have accepted, is altogether inadmissable; and the genus, which is dedicated to one of the most able of Australian zoologists, will stand as one of the most isolated in its family.

The figure represents the teeth of *T. huonensis*; those of *T. paradisiaca* are very similar. I have not examined the radula of *T. rufilabris.*

[1] Trans. and Proc. N. Z. Institute, xiv, p. 147, pl. 1, f. K, 1–4, (1882)

Tatea paradisiaca n. sp. Pl. IX, figs. 10, 11.

Shell narrowly pyramidal, the lateral outlines of the spire slightly concave above, apex obtuse. Whorls about 7½; the nucleus minute, the first whorl globose and relatively large, following whorls but slightly convex, separated by linear sutures, the last whorl either bluntly angular or rounded at the periphery, swelling in a low varix behind the peristome, then contracting, rather abruptly falling or deflexed for a short distance in front. Surface shining, showing excessively faint, fine spiral striæ in certain lights. Color, rich reddish-chestnut, becoming a little paler on the spire, and with the peristome of a decidedly darker shade.

Aperture ovate, rounded above, vertical; peristome obtuse and thick, continuous. Umbilicus hardly perforated. Alt. 4·8, diam. 2·5 mm.; alt. of aperture 1·5 mm.

Eden, New South Wales, Australia, in a brackish swamp (Dr. J. C. Cox, 1897).

This species differs from *T. rufilabris* (A. Ad.[3]) and *T. huonensis* (Tenison-Woods[4]) in being much broader in proportion to its heighth, of a darker color, and with strongly developed lip varix. The appearance of margination below the sutures, produced by transparence, is more conspicuous in *rufilabris* and *huonensis* than in our new species, and both of the former have the spire more at-

T. rufilabris and *T. huonensis* have been united by Mr. Smith, and the union has been accepted by Australian and Tasmanian writers. The differences mentioned above seem constant in the rather small series of each before me; so that I would suggest a renewed comparison of Australian and Tasmanian specimens by someone having abundant material, in order that Mr. Smith's decision may be confirmed or reversed. The series before me is hardly ample enough to justify an opinion adverse to that of so fair minded an investigator as my honored confrère of the British Museum, but is still sufficient to raise a doubt.

Genus ADEORBIS Wood.

Adeorbis sigaretinus n. sp. Pl. IX, figs. 4, 5, 6.

Shell much depressed, shaped somewhat like the flat *Sigaretus* species, upper surface slightly convex, base broadly and deeply umbilicated; thin, white. Whorls 4½, the first minute, brownish, elevated, the others convex, rapidly widening, the last very wide, rounded at the periphery and base, as well as on the umbilical margin. Sculpture, close and fine wrinkles of growth, somewhat irregular, and fine, crowded, thread-like spiral striæ. Aperture large, very oblique, subcircular, only slightly excised by the parietal margin; peristome thin and simple. Alt. 2, greater diam. 4·8, lesser 3·8 mm., or slightly larger, diam. 5·5 mm.

Rockhampton, Australia (Dr. J. C. Cox).

A. sigaretinus differs from *A. striatellus* from New Caledonia in the larger size, wider last whorl, open umbilicus without a bordering keel, and different ornamentation; Montrouzier's species being distinctly punctured along the striæ in the specimens before me, as stated in the original description. The absence of a constricting, delicate umbilical keel is a very obvious point of difference.

Genus CORBULA Bruguière.

Corbula Coxi n. sp. Pl. IX, figs. 1, 2, 3.

Shell solid, strong and quite inequivalve, inequilateral, very ventricose, the diameter nearly or quite equal to the height; in fully mature individuals, oblong, the beaks nearly central, anterior end rounded, posterior end narrower, very obliquely truncated, much narrowed below and projecting in a short truncate rostrum; basal margin moderately arcuate. Surface dull, whitish, with remnants of a thin yellowish cuticle at the ends. Right valve somewhat

larger, projecting beyond and closely overlapping the left along the whole basal margin. Both valves have the posterior area defined by a keel. Sculpture rather fine, irregular wrinkles parallel to growth lines, becoming coarser below, and obsolete toward the beaks, where numerous spaced radial carinulæ, linear and very delicate may be seen under the lens. Interior white, the right valve with a high, triangular, recurved tooth fitting into a corresponding deep process in the other valve.

Length 18·5, height 11, diam. 11 mm.

Length 17·5, height 11, diam. 9.3 mm.

Sydney Head (John Brazier), and Eden, Twofold Bay, New South Wales (Dr. J. C. Cox).

This species is probably the *C. nasuta* of Angas' lists of Australian mollusks, but it is not, in my opinion, the *C. nasuta* of Sowerby,[5] described from Xipixapi, west coast of Colombia. The latter is smaller, adults before me measuring 7·5 to 10 mm. long, and the beaks are somewhat different. In *C. nasuta*, as Reeve's figure shows, the larger valve projects above beyond the smaller, while in *C. Coxi* the two are nearly equal above. In *C. nasuta* the concentric ribs are more prominent on the anterior end than in *C. Coxi*. The posterior rostration is decidedly longer in *C. nasuta*. Sowerby's types measured: long 0·7, lat. 0·35, alt. 0·4 inch. These differences [redacted]

DESCRIPTIONS OF TWO NEW SPECIES OF CERION.

BY H. A. PILSBRY AND E. G. VANATTA.

Cerion Fordii P. & V. Figs. 1, 2.

Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5.

Shell cylindrical, the latter three whorls of equal diameter, those earlier forming a rather short, obtuse cone. Whorls 10 to 10½, earlier two white, smooth, the following finely striated, striæ or riblets evenly spaced though of variable closeness, in number 32 to 45 on the last or next to last whorl, not splitting or more numerous on the base of the shell, which is rounded, not compressed; umbilical chink short, subperforate. Color: longitudinally mottled with brown, ochre and snow-white; sometimes uniform white.

Aperture vertical or with the base somewhat advanced; parietal tooth about median, high, long and strong, extending backward about four millimeters. Columellar fold very slight, situated high. Peristome reflexed, its face much thickened; light brown or whitish; parietal wall generally heavily calloused.

Alt. 30, diam. of penult. whorl 12, alt. aperture 12½ mm.

Alt. 27, diam. of penult. whorl 12, alt. aperture 10½ mm.

Alt. 28½, diam. of penult. whorl 11, alt. aperture 11 mm.

Var. submarmoratum P. & V. Figs. 3, 4.

Like the type except that it is ribless, smooth with slight growth-wrinkles; sutures a little exserted and seam-like above. White, unicolored or with irregular longitudinal dark fleshy brown stripes and sometimes ochraceous stains. The first post-nepionic whorl of the cone is usually striated. Aperture typical.

Typical *C. Fordii* exactly resembles externally a coarsely sculptured form of *C. Dalli* from Inagua; but it has the internal armature of *Strophiops* or *Maynardia*. It is a coarser, larger shell than *C. eximeum* of Cat Island and New Providence, with far stronger development of peristome and teeth and more interrupted strigation. *C. Fordii* has not the raised ledge across the parietal wall of *C. glans varium*, from New Providence, has stronger peristome and teeth, and is larger.

The pure white form *C. Fordii* resembles *C. abacoense*, but is less stout in the average, has a liver-tinted mouth and lip, and the parietal tooth is notably longer and stronger.

Var. *submarmoratum* is a larger shell than *C. marmoratum*, stouter above, and with a much more developed parietal tooth. It has not the expanded umbilical area of *C. regina eucosmium*, of Turk's Island.

White specimens of this variety are very similar to *C. eleutheræ*, but do not taper gradually as that species, the angle of obliquity of the aperture is different, etc.

Several hundreds of this species were obtained by Mr. John Ford from a barrel of shells from the Bahamas, exact island unfortunately unknown. On comparison with the nearly complete series of *Cerion* in the collection of the Academy it is evident that a new poly- [redacted]

Aperture vertical; parietal tooth very small, weak and short; columellar fold distinct, extending inward one whorl. Peristome well reflexed, whitish, rather thin or thickened; parietal callus moderate or very thin.

Alt. 29, diam. of last whorl above aperture 11–12; alt. of aperture 11 mm.

Alt. 28½, diam. of last whorl above aperture 11; alt. of aperture 10 mm.

Gun Cay, Bahamas (Dr. Wm. H. Rush, U. S. N.).

The rather long and gradually tapering cone, smooth surface above, the last one or two whorls ribbed, and very small parietal tooth, are the most prominent features of this species. Its resemblance to *C. regina eucosmium* is remarkable; but the small area behind the columellar lip, with short rimation and rounded base, distinguishes it at once from that form. It is superficially not far from some of the Cayman Is. species, but has not the strong and long parietal tooth of those forms.

At the request of Dr. Rush this species is named in honor of Lieutenant-Commander John Elliott Pillsbury, of the U. S. Coast Survey Steamer "Blake."

ON THE ANNUAL MOLT OF THE SANDERLING.

BY WITMER STONE.

In March, 1896, Mr. Frank M. Chapman published a paper entitled "The Changes of Plumage in the Dunlin and Sanderling,"[1] his object being chiefly to controvert the theory of Gätke and others that these and other birds acquired their nuptial dress by an actual change in the color of the feathers of the winter plumage.

Mr. Chapman demonstrates conclusively, with the aid of a large series of specimens, that this change is effected by an absolute replacement of the old plumage by new and differently colored feathers.[2] In the case of the Sanderling, *Calidris arenaria*, Mr. Chapman describes the plumage changes of the bird in some detail, and in speaking of the annual molt says:—

"There is no reason to doubt that the Sanderling, like other birds, undergoes a complete molt after the breeding season; nevertheless, not one of my twenty August specimens shows any signs of molt in progress in the wings or tail. In the larger number, however, the remiges and rectrices are in an apparently fresh and unworn condition, and I assume that in most cases these important

[redacted]

large series in studying the molt and the erroneous conclusions which may be drawn from negative evidence."

In investigating the annual molt of the Sanderling, I had before me a series of sixty-seven skins taken from May to November, including besides those in the collection of the Academy of Natural Sciences of Philadelphia, a series from the U. S. National Museum and the American Museum of Natural History, kindly loaned by the authorities of these institutions.

The series of spring specimens which I have examined serves but to substantiate Mr. Chapman's account of the spring molt, and is not concerned with the present paper.

My series may be grouped as follows:—

Birds of the year in first plumage, 19 (Aug. 26th to Oct. 20th).

Birds of the year showing molt of the body feathers, 9 (Sept. 29th to Nov. 10th).

Old birds in nuptial plumage, 8 (May 21st to Aug. 14th).

Old birds showing molt, 28 (Aug. 2nd to Oct. 31st), 8 of which (Aug. 14th to Oct. 31st) show molt in the primaries.

Old birds in full winter plumage, 3.

The birds of the year, as is well known, molt the body plumage in the autumn and the black and white feathers of the back and head are replaced by light gray as in the winter adults.

The following table shows the progress of this molt:—

U. S. N. M., 106,443, Romney, Eng., Aug. 29th, one or two gray feathers.

A. M. N. H., 54,698, Devon, Eng., Sept. 10th, one or two gray feathers.

A. N. S. P., 34,169, Beach Haven, N. J., October, about 25 gray feathers.

U. S. N. M., 128,796, Aldabra Isl., Africa, Nov. 10th, about half the feathers gray.

U. S. N. M., 41,774, Merida, Yucatan, about half the feathers gray.

A. N. S. P., 34,873, Wolfville, N. S., Sept. 29th, gray feathers predominating.

U. S. N. M., 81,754, Ventura, Cal., Nov. 2d, molt complete.

Other specimens from Wolfville, N. S., taken Sept. 29th, and one from Havre, France, Oct. 20th, have not begun to change.

This shows the great variation in the time of the molt.

Some species of birds molt their remiges and rectrices with the first body plumage, but none of the specimens examined show any evidence of such molt in the Sanderling.

The possibility that some of the specimens described below which show molt in the primaries were birds of the year was considered, but all the evidence seemed to point to their being adults.

I feel convinced that the black tips to the wing and tail coverts will serve to distinguish birds of the year as pointed out by Mr. Chapman, even after the black and white feathers of the back and head have been entirely replaced, as they are still retained in birds that have entirely finished the molt.

The specimens illustrating the annual molt of the adults may be arranged as follows:

A specimen from Glacier Valley, North Greenland, taken June 14 (A. N. S. P., 30,197), shows the full nuptial plumage as do other specimens from Cape May, N. J., May 21st to June 13th.

One from Cape May, August, 14th is in worn nuptial plumage with one or two gray feathers on the back, but no further sign of molt.

Eighteen other specimens (Aug. 2d to Sept. 11th) show a varying amount of gray feathers in the plumage of the upper surface, giving them a mottled appearance. In all of these the spotting on the breast is still perceptible, and in at least half of them scarcely any molt has occurred in this part of the plumage. In none of them is there any molt in progress in the wing or tail, even the wing coverts being in every instance the worn nuptial plumage.

The primaries show great diversity as to abrasion, some being much worn and bleached to a dull brownish tint, while others are much blacker and comparatively so fresh looking that Mr. Chap-

[redacted]

The specimens included in this mottled series are as follows:—

A. M. N. H.,	35,752, etc., 8 specimens,	Chatham, Mass., Aug. 27th.
W. S.,	1,573,	Cape May, N. J., Sept. 11th.
U.S.N.M.,	59,714,	Tehuantepec, Mex., Aug. 5th.
A.N.S.P.,	33,744, 34,168, 2 spe'm'ns,	Beach Haven, N. J., Aug. 21.
U.S.N.M.,	30,310,	Spanishtown, Jam., Aug. 20.
U.S.N.M.,	94,714,	Hyde Park, Ill., Aug. 20.
U.S.N.M.,	111,789,	White I., Canada Bay, Aug. 2.
U.S.N.M.,	124,587,	Pt. Lookout, Sept. 8th.
U.S.N.M.,	1,011,	Devon, Eng., Aug. 26th.
A. M. N. H.,	51,171,	Rockaway, L. I., Aug. 4th.

The next series of eight birds shows the continuation of the molt. In all of these the gray predominates on the back, many of them being practically like winter birds, having lost nearly all the old body feathers. In all, however, the molt is in progress in the remiges, and in most cases in the rectrices also, while in all but the most advanced, remains of the old wing coverts may be seen in varying quantity.

These birds in detail are as follows:—

	Last primary molted	Molt in secondaries	Molt in tertials.	Molt in wingcoverts	Molt on back.
Cape May, N. J., Aug 14..	4	None.	None.	Half completed.	About 20 old feathers remain.
Cape May, N. J., Aug 14..	4	None.	Half completed.	Half completed.	About 25 remain.
U. S. N. M., 151,633, Margarita Island, Venezuela, July 7	4	2 renewed	About completed	Almost completed	About 12 remain.
U. S. N. M., 128,795, Aldabra Isl., Oct. 8	4	All but 3 renewed.	Complete.	Complete.	Complete.
U. S. N. M., 128,793, Aldabra Isl., Oct. 8	4	Complete.	Complete.	Complete.	Complete.
U.S.N.M., 110,029, Kauai, Hawaiian Isl	3	All but 3 renewed.	Complete.	Complete.	Complete.
A. N. S. P., 26,178, Cape May, N. J., Sept. 14	2	Complete.	Complete.	Complete.	Several old feathers remain.
U.S.N.M., 102,064, Tambo Valley, Peru, Oct. 31	6	None.	Complete.	Nearly complete.	Several old feathers remain.

This shows great variability in the time of completing the molt and the relative progress of molt in different parts of the plumage.

One point which seems to be borne out by all the specimens is that the body plumage is pretty well renewed before the remiges begin to molt, and that consequently the molt of these feathers occurs after the bird starts on its migration.

If, as Mr. Chapman assumed, the mottled birds which showed no trace of molt in the remiges and rectrices, had already renewed these feathers, we would have a condition contrary to that found in any group of birds which I have examined, i. e., the completing of the molt of the remiges before the molt of the coverts begins.

Better evidence, however, is to be found in the fact that in some of the molting specimens above described the primaries that are being replaced are quite as fresh as those in the mottled birds already mentioned.

Why there should be this great difference in the wear of the remiges I am unable to say; and I am equally at a loss to account for the peculiar appearance of some birds in which the two outer primaries are in a wonderfully better state of preservation than the inner ones, the difference between the second and third being very marked. All the evidence so far seems to point to the same order of molt in the feathers of the wing of these birds as is seen in the *Passeres*.[4]

Two specimens given in the above table deserve special comment. The Margarita Island specimen is remarkable from the fact of its capture so far south at so early a date (July 7), as well as in having so nearly completed its molt. It may, perhaps, have been a wounded [redacted]

CONTRIBUTIONS TO A KNOWLEDGE OF THE HYMENOPTERA OF BRAZIL, NO. 3. SPHEGIDÆ (sens. lat.).

BY WILLIAM J. FOX.

This paper forms a continuation of the reports on the collections of Hymenoptera made by and belonging to Mr. Herbert H. Smith. At least one more paper will follow, on the Thynniidæ, which will also contain some additions to the earlier reports.

Ampulex trigonopsis Sm.

A single specimen from Chapada (October), I doubtfully refer to this species. It agrees with Smith's description, but there are two large teeth on each side of the projecting carina of the clypeus, of which Smith makes no mention.

Sceliphron (*Trigonopsis*) **rufiventre** Fabr.

Five specimens from Maruru (April) and Santarem.

Sceliphron (*Podium*) **denticulatum** Sm.

Chapada (December); Santarem. Two specimens.

Sceliphron (*Podium*) **consanguineum** Sm.

Two specimens from Chapada (March) and Rio de Janeiro (October) are doubtfully referred to this species.

Sceliphron (*Podium*) **flavipenne** Lep.

Two specimens, ♀. Rio de Janeiro (November) and Santarem.

Sceliphron (*Podium*) **romandinum** Sauss.

Two examples of this fine species. Santarem (September).

Sceliphron (*Podium*) **haematogastrum** Spin.

Fourteen ♀ and thirteen ♂ specimens. This species is quite distinct by red legs and abdomen. The latter, however, becomes quite dark in some specimens, and the petiole is sometimes black and varies a little in length; the point of reception of the recurrent veins by the second submarginal cell is not constant.

Three specimens differ by having the wings subhyaline, not yellow, and may prove distinct. Perhaps they represent Saussure's *Podium egregium.*

Sceliphron fistulare Dhlb.

Six specimens. Pedra Branca and Maruru (April); Chapada.

Sceliphron figulum Dhlb.

Two specimens. Corumbá and Uacarizal (February).

Ammophila opulenta Guér.

A large series of this species from various localities. It is disguished by its large size and strong tubercle of mesopleura. The male has the clypeus prominently produced into a tooth, and together with the face, covered with golden pubescence. It is best distinguished by the strongly tuberculate mesopleuræ.

Ammophila miliaris Cam.

Twelve male specimens. Chapada (January to March); Santarem. Greatly resembles *opulenta*, but the mesopleuræ not tuberculate and clypeal prominence shorter.

Ammophila abbreviata Fabr.

A large series of both sexes.

Ammophila aureo-notata Cam.

One female and nine male specimens. Chapada (March, April); Corumbá and Pedra Branca (April); Santarem.

Ammophila moneta Sm.

Four female and five male specimens. Uacarizal (February); Pedra Branca and Chapada (April); Santarem.

[redacted]

pleuræ not tuberculate, with an ⟩-shaped furrow ; petiole composed of two joints; wings subhyaline, apices broadly darker, second submarginal cell subtriangular, narrowed more than one-half above, the first recurrent vein received near the middle, the second near apex. Entire insect deep black, abdomen velvety; face and clypeus with sparse fuscous pile; spot on tubercles and large one at each side of apex of middle segment, bright silvery. Length 22 mm.

♂.—Face and clypeus densely golden; clypeus drawn out into a median prominence, which is short and obtuse, and before which the clypeus is visibly depressed; space between hind ocelli nearly equal to that between them and eyes; dorsulum with rather dense pale pile, and, in addition, with a short, erect, pale fuscous pubescence; thorax sculptured as in the ♀; tegulæ silvery anteriorly. Length 22 mm.

Chapada (March). Three specimens. Has the general appearance of *abbreviata*.

Sphex (*Chlorion*) **hemiprasinus** Sichel.

Chapada (October). Three specimens.

Sphex (*Chlorion*) **cyaniventris** Guér.

One specimen ; same locality and date as the preceding.

Sphex (*Isodontia*) **nigrocaeruleus** Tasch.

Nine ♀, three ♂ specimens. Chapada (March, April).

Sphex (*Isodontia*) **costipennis** Spin.

Five ♀, nine ♂ specimens; Chapada (February, March); Maruru and Pedra Branca (April); Santarem.

Sphex (*Isodontia*) **laevipes** n. sp.

♀.—Black, with grayish pubescence; face, clypeus, thorax beneath, hind coxæ, an oblique line on sides of middle segment (sometimes absent) extending to insertion of petiole, silvery ; tegulæ, legs entirely or in part, petiole (the latter sometimes black) wine colored; wings fusco-hyaline, costal half much darker; clypeus bidentate, with long, sparse, pale hairs; eyes converging toward mandibles, the latter bidentate; space between hind ocelli nearly equalling that between them and eyes; first joint of flagellum not quite as long as the two following united; dorsulum and scutellum with distinct, separated punctures; middle segment rather coarsely granulated; the mesopleuræ with coarse punctures; legs comparatively scarcely spinose, spines of fore tarsi short; petiole about as

long as the first three hind tarsal joints; last ventral segment convex. Length 17–18 mm.

♂.—Colored like the ♀; but in one example the thorax except dorsulum, is more or less wine colored; clypeus more convex, its apex broadly incurved, silvery pubescence denser; first joint of flagellum nearly as long as two following united; scutellum impressed medially. Length 18 mm.

Uacarizal (February); Chapada (March). Three ♀, one ♂ specimens. *S. laevipes* is probably the form mentioned by Kohl as a dark variety of *S. costipennis*, his specimen, a ♂, having come from Rio Grande do Sul. It differs from *costipennis* not only in color, but by the smoother legs, longer petiole of ♀, etc.

Sphex (*Isodontia*) **azteca** Sauss.

One specimen, a ♂. Chapada (March).

Sphex caliginosus Er.

Fifteen ♀, 22 ♂ specimens. Chapada (March, April); Santarem.

Sphex fuliginosus Klug (= *congener* Kohl).

A large series of females. Chapada (March, April).

Sphex Servillei Lep. (= *latior* Er. = *roratus* Kohl).

I have no doubt that *latior* is identical with *Servillei*. The large series present, indicates a common occurrence. Chapada (January, [redacted]

Sphex flavipes Sm.

One ♀, six male specimens of the var. *Iheringii* Kohl. Chapada (February, March).

Sphex ichneumoneus Linné.

Four specimens of the typical form from Santarem (February) and Maruru (April). Three of the var. *dorsalis* from same localities. Over thirty of the var. *sumptuosus* collected from February to April.

Sphex dubitatus Cress.

The geographical distribution of this species is extended considerably by three specimens in the present collection, collected at Chapada (February, March) and Corumbá (April). There is also a specimen in the collection of the American Entomological Society marked Mexico.

Four specimens, which may be the ♂ of this species, have the pubescence denser and more golden, particularly on head in front; antennæ rather long and slender, first joint of flagellum about as long as second and three-fourths of third joint united; face much narrower than in *ichneumoneus*; petiole about as long as second and third hind tarsal joints united; legs more or less black; abdomen with more or less black blotches above; last ventral plate tridentate apically, the central tooth prolonged, with a carina which runs almost to base of segment, laterally the segment bears a bunch of long yellowish hairs, somewhat concealing the lateral teeth. Length 17–18 mm.

Corumbá and Pedra Branca (April).

Sphex ferrugineipes n. sp.

♀.—Head and thorax black, with pale, not dense pubescence; face, clypeus at sides, line on pronotum, sides of dorsulum and spots on sides of thorax and at apex of middle segment with silvery pile; mandibles, except apex, tegulæ, legs, except coxæ, and base of trochanters, and abdomen, except petiole, entirely, or in part, bright red; eyes but slightly converging beneath; face somewhat narrower than in *ichneumoneus;* clypeus convex, emarginate medially, having the appearance of being bidentate, or entire, front distinctly punctured; space between hind ocelli about equal to that between them and eyes; dorsulum with rather strong separated punctures, those of mesopleuræ finer and evener; middle segment above with a transverse, indistinct striation; tarsal comb well devel

first fore tarsal joint with six to seven spines; petiole black, shorter than combined length of second and third hind tarsal joints; abdomen above and beneath with a distinct, sparse punctuation; wings subhyaline, not yellowish, apical margins broadly darker. Length 20–22 mm.

♂.—Colored and clothed like the ♀, the fore margin of the clypeus in addition being sometimes reddish; space between hind ocelli a little greater than that between them and eyes; first joint of flagellum shorter than the second and third united, the second a little shorter than the third; last ventral plate indistinctly carinated down middle, its apex prolonged triangularly in the middle. Length 19–21 mm.

Chapada (March, April, October); Corumbá (April). Three ♀, 10 ♂ specimens. Distinguished from *ichneumoneus*, *dubitatus*, etc., by sparser pubescence, bright red of abdomen, strongly punctured dorsulum (and clypeus in ♀), shape of last ventral plate in ♂, etc.

Sphex (*Prionouyx*) **Thomæ** Fabr.

Quite a large series of both sexes from various localities, collected in the months of February, March, April, June, September.

Sphex (*Prionouyx*) **bifoveolatus** Tasch.

Twenty-seven ♀, 13 ♂ specimens. Chapada (March, April, November); Corumbá (April).

[redacted]

tral area; petiole of abdomen about as long as hind femur, flat above, not sulcate; apical margins of segments testaceous; wings dark subhyaline, iridescent; stigma testaceous, nervures darker; second and third submarginal cells each receiving a recurrent nervure, second submarginal cell narrowed about one-third above; basal vein and cubital of hind wing interstitial. Length 10 mm.

Chapada (April). One specimen. Allied to the North American *P. fuscipes*.

Stigmus neotropicus Kohl.

One specimen. Corumbá (May).

Stigmus hexagonalis n. sp.

♀.—Black; mandibles, except apex, yellowish; tegulæ, tubercles, antennæ and legs, including coxæ, reddish-brown; cheeks angularly produced beneath; head shining, not striated; ocelli forming a low triangle, placed in pits; the space between hind pair much less than that between them and eyes; clypeus acutely bidentate medially; prothorax above marked by a transverse series of strong foveæ, the antero-lateral angles of pronotum acutely produced, as are also the sides of prothorax; dorsulum punctured, with three deep parallel furrows, the middle one of which runs to apex, the others hardly half as long; suture between dorsulum and scutellum foveolate; middle segment coarsely reticulate, at base above with a hexagonal enclosure, which bears a longitudinal medial fold; petiole robust, shorter than hind tibiæ, with two deep sulci above, between which runs a rather sharp ridge. Length 5 mm.

Chapada (December, January); Corumbá (May). Three specimens. Seems to be allied to *S. temporalis* Kohl, from Guatemala, of which only the ♂ is known.

Trachypus Romandii Sauss.

Two specimens. Chapada (November, December).

Nysson tomentosus Hdl.

Chapada (December). One specimen.

Nysson pilosus Sm.

Uacarizal (February). One specimen.

Bothynostethus sp.

A ♂ specimen from Santarem I am unable to refer to any of the three described species of *Bothynostethus*. It agrees with *Saussurei* in the color of wings, but the mandibles are deeply excised and the

second discoidal cell is much higher than broad. In the two latter characteristics it approaches the Mexican *B. nitens*, but differs in color of wings and larger size (10 mm.). The clypeus is dentate laterally as in *Saussurei*, of which it is, perhaps, the ♂.

Scapheutes brasilianus Hdl.

One specimen. Chapada (March).

Gorytes specialis Sm.

Four specimens that agree fairly with the description of *specialis*. It is evidently close to *G. polybia* Hdl., but the suture between dorsulum and scutellum is not foveolate. Chapada (January); Marurú; Santarem.

Gorytes facilis Sm.

Four specimens. Corumbá (January, April); Santarem. This species belongs, apparently, to the group of *G. simillimus* as defined by Handlirsch in his monograph.

Gorytes scutellaris Spin.

Marurú (April); Chapada (April, November); Santarem. Nine examples.

Gorytes seminiger Dhlb.

One specimen. Rio de Janeiro (November).

Gorytes cayennensis Spin.

[redacted]

rather strong, even punctuation, and anteriorly in the middle with two, closely parallel, impressed lines; the remainder of thorax punctured, but less closely than dorsulum, the apex of the large basal area of middle segment being almost smooth; the middle segment is short and rounded; mesosternum not at all carinated; the episternum and epimerum distinctly separated; wings subhyaline, yellowish along costa, darker in marginal cell; submedian cell of hind wings terminating beyond the origin of the cubital vein; legs stout, the tibiæ serrato-spinose, the spines pale; abdomen robust, more granulate than punctate, on the first segment, however, and ventrally punctured; held in certain lights the abdomen is covered with golden pile, the apical segments with long, yellowish hairs; first segment meeting the second broadly, the latter depressed at base above, ventrally truncated at base, and with a tubercle, so that when viewed from the side it is angularly produced; pygidium large, well developed, aciculate, covered with golden pubescence. Length 14–26 mm.

Chapada (December). Three specimens. Seems to be very distinct from any *Gorytes* heretofore described. It seems intermediate of the groups *mystaceus*, *nigrifrons*, etc., and *fuscus*, *robustus*. It agrees with the former in shape of second ventral segment, but the recurrent veins are both received by the second submarginal cell. From the *fuscus* group the former of these two characteristics will separate it. Then again in the eyes, strongly converging toward clypeus, it also differs. Except for the second ventral segment it is not unlike *G. moneduloides*, but it is a much more robust insect.

Gorytes partitus n. sp.

♀.—Head and abdomen, except first segment, black; thorax, first abdominal segment and legs reddish-brown; clypeus, except medially, labrum, base of mandibles, spot at base of antennæ, scape beneath narrow line on pronotum, dorsulum at sides, tegulæ, spot beneath them, scutellum, postscutellum, large spot at each side of middle segment, base of first abdominal segment, and four anterior tibiæ and tarsi in part, yellow; eyes distinctly converging beneath clypeus transverse, punctured, broadly truncate; antennæ but little thickened apically, the first joint of flagellum about one-third longer than second; thorax practically impunctured; suture between dorsulum and scutellum foveolate; mesosternum carinated, the epimerum and episternum separated; middle segment convex, divided by a furrow its entire length, the basal area large; tibiæ and tarsi

distinctly spinose, pulvilli large, fore tarsi distinctly ciliated; abdomen subpetiolate, the first segment scarcely coarctate at apex; second dorsal segment depressed at base, second ventral convex; pygidium distinct, longitudinally rugose; wings subhyaline, fuscous along costa and in marginal cell, nervures dark, stigma brown, submedian cell of hind wings terminating distinctly beyond origin of cubital vein: head and thorax with silvery pile, that on the dorsulum brownish. Length 14 mm.

Chapada (December). One specimen. Seems to be related to *notabilis* Hdl., and *fumipennis* Sm.

Gorytes coloratus n. sp.

♀.—Head and thorax black, abdomen, and legs in part, reddish-brown; scape, clypeus sometimes, mandibles basally, pronotum, scutellum anteriorly, postscutellum, spot beneath tegulæ, and on each side of segments 2 and 3, or 2–4, anterior tibiæ and tarsi entirely, medial tibiæ, medial tibiæ within, and medial, and hind tarsi more or less, yellowish; flagellum beneath at base, tegulæ, tubercles, reddish-testaceous; dorsulum somewhat iridescent; head broader than long; frontal impression deep; eyes large, strongly flattened anteriorly, strongly converging toward clypeus; ocellii forming a low triangle, placed in depressions; clypeus distinctly punctured, strongly depressed transversely before the anterior margin; scape longer than the two following joints united, first joint of flagellum nearly as long

[redacted]

cubital veins respectively; cubital cell of hind wings terminating much before origin of cubital vein. Length 9 mm.

Marurú (April); Santarem. Two specimens.

This species belongs, no doubt, close to *G. violaceus* Hdl., described from a single defective specimen from Brazil, which, with other parts, lacked the abdomen. The present species is clearly more allied to the *bipunctatus* group than to *chilensis*, and it is probable that it and *violaceus* form a group. In coloration this new species seems quite distinct from its allies; it would be interesting to know whether the abdomen of *violaceus* is similarly colored.

Bembidula discisa Tasch.

Chapada (January, February, March, September, October). Twenty-three specimens.

Bembidula variegata Oliv.

Chapada (January, March, September, October, December). Fifteen ♀, five ♂ specimens.

Monedula signata Linné.

Chapada (March). Three females.

Monedula punctata Fabr.

Eleven ♀ specimens. Chapada (March).

Monedula surinamensis DeG.

Twenty specimens, representing both sexes, collected in January, April, September to December, chiefly at Chapada.

Monedula magnifica Perty.

Chapada (March, April). Sixteen specimens, all females, of this handsome species.

Stizus Bolivarii Hdl.

Chapada (January, December); Corumbá (February, April); Santarem. Ten specimens, which are probably this species. They have all the abdominal segments fasciate.

Trypoxylon pallitarse Sauss.

Five specimens. Santarem (February).

Trypoxylon niveitarse Sauss.

Ten specimens. Chapada (January, October, December); Santarem.

Trypoxylon rufosignatum Tasch.

Chapada (April). Three specimens.

Trypoxylon fabricator Sm.

Chapada (October). Three specimens. This species is probably identical with *T. gracile* Tasch.

Trypoxylon superbum Sm.

Chapada (April). One specimen.

Trypoxylon lævifrons Sm.

One specimen. Chapada (October).

Trypoxylon læve n. sp.

♀.—Deep black, shining; pubescence pale; hind tarsi except base and apex, dirty white; front with distinct, shallow punctures, furrowed from before anterior ocellus to a slight prominence just behind antennæ; first joint of flagellum about as long as the two following united; space between eyes above about equal to length of first joint of flagellum, beneath at clypeus it is somewhat less; clypeus carinated down middle, somewhat depressed laterally, its fore margin in the middle subtruncate; face and clypeus with silvery pubescence; thorax is distinctly punctured; middle segment with the posterior surface transversely striated, carinated laterally, parted by a deep furrow, the upper surface slightly depressed apically, sides apparently smooth; abdomen rather slender, much more elongate than in allied species, first segment slender, somewhat nodose at apex, fully one-third longer than second segment; the abdomen [redacted]

or folds, deeply impressed down middle; the anterior ocellus is placed in this furrow, which becomes shallower below and terminates in a flat projection over the bases of antennæ; first joint of flagellum a little shorter than the two following united; clypeus not carinated, prominent and rounded at apex; thorax finely punctured, nearly smooth; tegulæ testaceous; middle segment above parted by a deep furrow, which is transversely striated, and on each side of which another less distinct, curved furrow is present, posterior surface also parted by a furrow, finely and transversely striated; abdomen elongate, slender, the first segment almost linear on basal two-thirds, slightly nodose, its length equal to the following segments united; wings subhyaline, iridescent, nervures dark. Length 11 mm.

♂.—Clypeus shorter, subtruncate; first joint of flagellum slightly longer than two following united, apical joint small, not much longer than the preceding one; middle segment with the furrow deeper than in ♀, and the upper and posterior surfaces coarsely and transversely striated; space between eyes at top greater than length of first joint of flagellum, beneath at clypeus it is slightly less. Length 12 mm.

Rio de Janeiro (November); Santarem. One of each sex. Related to *fabricator* Sm. and *gracile* Tasch. The space between eyes at top and at clypeus is less in the ♀, than in the ♂, an unusual circumstance.

Trypoxylon medianum n. sp.

♂.—Black; sides of first and second segments, and the latter at base, reddish; clothed with pale pubescence, that on face, clypeus, tubercles, and postero-lateral angles of middle segment, pale golden; a silvery stripe runs below from tegulæ; clypeus tridentate at apex, the median tooth acute and longest; front apparently granulated, feebly impressed; a longitudinal raised line behind base of antennæ; space between eyes at top but slightly greater than that between them at the clypeus, somewhat greater than the length of first joint of flagellum; the latter subclavate, first joint about as long as two following united, the ultimate joint small, not much longer than the preceding one; dorsulum and scutellum with distinct, separated punctures, those of mesopleuræ finest; middle segment above finely punctato-striate, the posterior surface with distinct transverse striæ deeply furrowed down middle, sides punctured; hind trochanters not dentate; abdomen clavate, rather stout, first segment a little

nodose, as long as the two following united; wings subhyaline, apical margins fuscous, nervures dark. Length 13 mm.

Corumbá (April); Santarem. Two specimens.

Trypoxylon fallax n. sp.

♀.—Black; sides of the first and second segments and base of the latter reddish; face, clypeus and suture below tegulæ with silvery pubescence, that on pronotum pale golden; other pubescence pale; front coarsely granulated, with a prominence or tubercle behind antennæ, and above it a V-shaped depression; ocelli situated in depressions; space between eyes at top about equal to length of first joint of flagellum, beneath at clypeus somewhat less; clypeus flat, somewhat roundly produced, emarginate in middle of fore margin; thorax with distinct separated punctures; above the middle segment is finely punctato-striate, depressed slightly at apex, the posterior surface more distinctly striated and sulcate down the middle; first abdominal segment slightly nodose at apex, about one-quarter longer than the second; wings subhyaline, nervures dark testaceous. Length 13 mm.

Var. (?). More subtilely punctured; clypeus entire.

♂.—Similar to ♀, with the reddish color on abdomen more extended, the base of segments, 2–3 being of that color, and first joint of tarsi pale at base; clypeus roundly emarginate; first joint of flagellum slightly curved, the last joint but little longer than the

[redacted]

Crabro pugnans Sm.

Chapada (April). One specimen. *Pugnans* belongs to the group *Crossocerus*.

Crabro carinatus Sm.

Two specimens. Pedra Branca (April); Rio de Janeiro (November). Seems to belong to *Solenius* group, as characterized in Kohl's table.

Crabro verticalis Sm.

Fourteen specimens, all females. Chapada (January, March, May, December). This species apparently belongs to *Crossocerus* group.

Crabro atitlanæ Cam.

Two specimens from Rio de Janeiro (November) and Benivedes (July) I refer with some doubt to *atitlanæ*. If not identical they are closely allied.

Crabro productus n. sp.

♀.—Head large, closely punctured; ocelli in a curved line, space between hind pair slightly, if anything, less than that between them and eyes; clypeus sharply carinated, its fore margin rounded medially; first joint of flagellum about one-third longer than second; pronotum bordered anteriorly by a sharp carina, terminating in a small tooth laterally; dorsulum rugoso-punctate, more sparsely posteriorly, depressed down middle and bicarinate; scutellum with large, separated punctures; mesopleuræ longitudinally rugose, the mesosternum shining, with distant punctures; middle segment divided by a longitudinal furrow, which is deepest within the basal enclosure, which is large and rather finely rugose; posterior face with transverse folds on rugæ, not margined laterally, the sides microscopically striated; tibiæ distinctly spinose; first dorsal abdominal segment with coarse, separated punctures, with a margin of fine ones at apex; the second segment less strongly punctured; the remaining dorsals finely punctured; ventrals shining, the second with large, sparse punctures, the third, fourth and fifth with a transverse series of punctures before apex; pygidium narrow, rounded at apex, depressed, with large punctures. Black; cheeks and sides of thorax with silvery pubescence, that on face and clypeus golden, silvery in part in certain lights; scape, line on mandibles, pronotum, tubercles, line on metanotum, spot at apex of four anterior femora beneath, a line on all the tibiæ externally, the hind pair almost entirely, base of hind tarsi, large spot on each side of first

two dorsal segments connected by a narrow line, a medially narrowed fascia on dorsals 3–5, sixth almost entirely and a short line at each side of ventrals 2, 3, or 2–4, at apex, yellow; wings subhyaline, nervures testaceous. Length about 9 mm.

♂.—Similar to ♀; space between hind ocelli distinctly less than that between them and eyes; third and fourth joints of flagellum uniting in such a way as to form an emargination beneath, the fourth joint rather prominent at apex; furrowing forming the enclosure of middle segment foveolate; punctuation of mesosternum and second ventral segment finer and closer than in the ♀, but that of the abdomen dorsally is coarser; four anterior femora yellow at apex, a spot at apex of hind pair beneath; joints 1–3 of medial tarsi produced at apex on inner side. Length 8 mm.

Chapada (March, April, November, December). One ♂ example is very small, 5 mm. According to Kohl's table, belongs in the *Solenius* group.

The collection also contains several additional species of *Crabro*, probably new to science, but represented by single specimens.

A REVISION OF THE GENUS SYNIDOTEA.*

BY JAMES E. BENEDICT, PH.D.

Among the unnamed Isopods in the National Museum seven species regarded as new have been referred to *Synidotea* as defined by Harger. Of the eight described species of the genus, five were in the collection and an additional one was loaned by the California Academy of Sciences. With so many new, and six of the eight described species at hand, it was thought best to treat the genus monographically, and the descriptions of the two remaining species were added.

The new species all come from the North Pacific Ocean and Bering Sea. One was taken in San Francisco Bay by Mr. C. H. Townsend while examining the oyster beds for the U. S. Fish Commission; the others were dredged by the 'Albatross,' one off the State of Washington and five in Bering Sea; two of the latter had, however, previously been taken by Mr. W. H. Dall.

The bathymetrical range of the genus is from shallow water to 695 fathoms. The geographical range is as follows: One species in South African waters, one from Japan, one from Lower California, two from California, one off the State of Washington, seven in Bering Sea and the adjacent waters of the Arctic Ocean, and two from the North Atlantic.

The genus *Synidotea* was instituted by Harger in 1878 to receive *Idotea bicuspida* Owen and *I. nodulosa* Krøyer. The two species now represent the two sections of the genus; the *bicuspida* section contains eleven and the *nodulosa* four species. All of the species come well within the limits of the genus.

The antennæ of all have multi-articulate flagella. The palpus of the maxillipeds has but three joints. The epimera of the four anterior segments are indicated, if at all, by a slight notch or pit in the posterior margins midway between the lateral margins and the median line; the epimera of the three posterior segments are distinctly outlined in a dorsal view, and are solidly united to the true

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segmental margins. The abdomen is composed of two segments united above but separated at the sides by short incisions.

In addition to the above generic characters, most species agree in having the head excavated in front, a cross-like areolation between the eyes, the extremities of the cross being usually armed with tubercles or spines; in having a spine or tubercle between the eyes and the front. A deep transverse suture near the back of the head cuts off a postcephalic lobe or areolation; between this areolation and the cross are two lateral areolations, sometimes united at the base and sometimes separated by a channel. The sides of the thorax in all species show undulations or nodules of more or less prominence.

The section of the genus of which *bicuspida* is the type is characterized by having the distal end of the abdomen emarginate or bicuspid, while in the *nodulosa* section the end is bluntly pointed.

The basal plates of the operculum in all species except *harfordi* are crossed by a diagonal line or ridge.

SYNIDOTEA Harger.

Synidotea Harger, American Journal of Science (3), XV, p. 374, 1878.

Edotia Miers, Journal Linn. Soc. Lond., XVI, p. 65 (pars),[1] 1883.

Synidotea G. O. Sars, Norwegian North Atlantic Expedition, Crust., p. 116, 1885.

Synidotea Harger, character emended.

[redacted]

Key to Species Examined.

a Abdomen emarginate or notched at the distal end.
  b Two spines or tubercles overhanging the frontal notch.
    c Spines united near the base. *pallida*
    c′ Tubercles free at the base. *erosa*
  b′ No spines or tubercles overhanging the frontal notch.
    c With a low ridge arising between the eyes and interrupted on the median line.
      d Outlines of abdomen subparallel. *nebulosa*
      d′ Outlines strongly arcuate. *angulata*
    c′ Without a ridge between the eyes.
      d Outline of abdomen subtriangular.
        e Front not excavated. *consolidata*
        e′ Front excavated.
          f Outlines of thorax subparallel. *marmorata*
          f′ Outlines of thorax strongly arcuate. *bicuspida*
      d′ Outlines of abdomen rounded.
        e Length of abdomen equal to width at base. *laticauda*
        e′ Length of abdomen equal to one and one-half times the width at base. *harfordi*
a′ Abdomen pointed.
  b Undulations of the body not tubercular or spiny.
    c Tubercle in front of the eyes not margined. *nodulosa*
    c′ Tubercle on the frontal margin and forming a part of it. *lævis*
  b′ Undulations of the body tubercular and spiny.
    c Four spines on the front of the head; body spinous. *muricata*
    c′ A wedge-shaped tubercle behind the frontal notch; body tubercular. *picta*

Synidotea bicuspida (Owen). Fig. 1.

Idotea bicuspida Owen, Crustacea of the 'Blossom,' p. 92, pl. xxvii, fig. 6, 1839.
Idotea pulchra Lockington, Proc. Cali. Acad. Sci., VII p. 44. 1877.
Edotia bicuspida Miers, Journal of the Linnean Society of London, XVI, p. 66, 1883 (pars).
Synidotea bicuspida Sars, Crustacea, Norwegian North Atlantic Exped., p. 116, pl. X, figs. 24-26, 1885; equal to *Synidotea incisa* Sars, Crustacea et Pycnogonida nova, etc., No. 8.

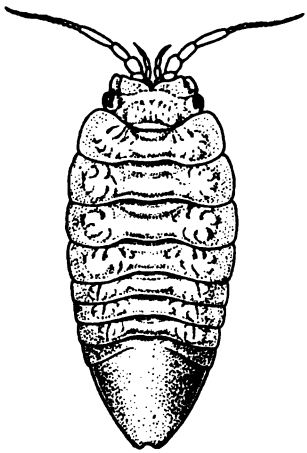


Fig. 1. *Synidotea bicuspida* (Owen). x $\frac{2}{1}$.

There are a large number of specimens of this species in the collection from Bering Sea and the Arctic Ocean. The species is the largest and its shell is the heaviest and strongest of any in the genus. This and the closely related Atlantic form, *S. marmorata* Packard, and the small Californian species *S. consolidata* (Stimpson), are easily distinguished from any known species by the triangular abdomen with a comparatively sharp bicuspid apex. Some of the largest specimens measure 31 mm. in length and 14.5 in width.

Shallow water to 56 fathoms.

Synidotea marmorata (Packard). Fig. 2.

Idotæa marmorata Packard, Memoirs Boston Society of Natural History, I, p. 296, pl. viii, fig. 6, 1867. Whiteaves, Canad. Nat., p. 262, 1875.

Idotea marmorata equals *I. bicuspida* Streets and Kingsley, Bulletin Essex Institute, IX, p. 108, 1877.

? *Idothea rugulosa* Buchholz, Zweite Deutsche Nordpolarf., II, p. 285, 1874.

Synidotea bicuspida Harger, Proceedings U. S. National Museum, II, p. 160, 1879; also U. S. Fish Commission Report for 1878, p. 352, 1880.

Edotia bicuspida Miers, Jour. Linn. Soc. Lond., XVI, p. 66, 1883 (pars).

[redacted]

smaller than those of *bicuspida*; a larger series might change this. The largest male *S. marmorata* measures 18 mm. in length and 7 mm. in width. A male *S. bicuspida* of about equal size, measures 17 mm. in length and 8 in width.

Synidotea consolidata (Stimpson). Fig. 3.

Idotea consolidata Stimpson, Proc. Cal. Acad. Sci, I, p. (89) 97, 1856, also Boston Jour. Nat. Hist., VI, p. 503, 1857.

Edotia bicuspida (nec *Idotea bicuspida* Owen) Miers, Jour. Linn. Soc. Lond., XVI, p. 66, 1883 (pars).

Two specimens of this species, labelled 'Pacific Grove, California,' were received from Mr. J. O. Snyder.

The front is emarginate, the median notch is large. The deep excavation of the front in *S. bicuspida* is in sharp contrast to the nearly straight front of this species. Behind the frontal notch is a pair of large, blunt tubercles transversely placed. The lateral margins of the thorax are subparallel in the male and strongly arcuate in the female. The margins are incised in this species; in *bicuspida* they are full. There is a line of low swellings on the median line and another line of like swellings part way between the median line and the margin. The abdomen is much like that of *bicuspida*.

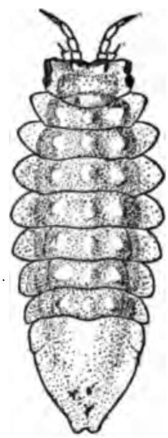


Fig 3. *Synidotea consolidata* (Stimpson). x ½.*

Synidotea laticauda, new species. Fig. 4.

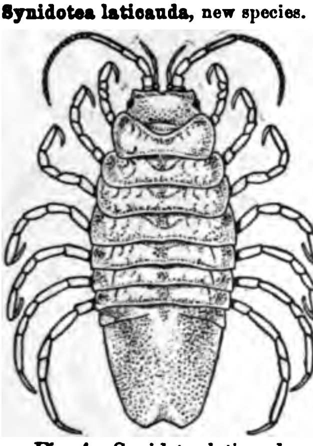


Fig. 4. *Synidotea laticauda* Benedict. x 2½

A single specimen of *Synidotea* was taken by Mr. C. H. Townsend in San Francisco Bay; it is readily distinguished from any species yet described.

The head is wider than long, the anterior margin is nearly straight and is slightly produced horizontally; its whole upper surface is evenly swollen and has neither elevations nor depressions of any kind; the cephalic lobe is little more than indicated. The eyes are large, round, lateral and but very slightly projecting. The antennæ are equal

* Incorrect. The antennæ should be placed as in the others and show seven or eight joints in the flagella.

to the head and thorax in length, the flagellum has twenty-one articles. The basal segment of the peduncle is short, reaching but a little beyond the front; the second segment is as broad as long; the third segment is about once and a half as long as broad; the fourth is a little more than twice the breadth; the fifth is nearly as long as the third and fourth together. The antennulæ extend a little beyond the base of the fourth segment of the antennæ.

The thorax is widest at the fourth segment. From the sides of the fourth segment the outline curves around to the eye. Posteriorly from the fourth segment the outline is straight to the distal third of the abdomen. The second, third and fourth segments are longest. There are no spines or tubercles anywhere and the rugosities so common to the species of the genus are barely indicated.

The abdomen is very little longer than its breadth at the base. It tapers gradually for the first two-thirds of its length where it begins to taper more rapidly to a broad emarginate extremity.

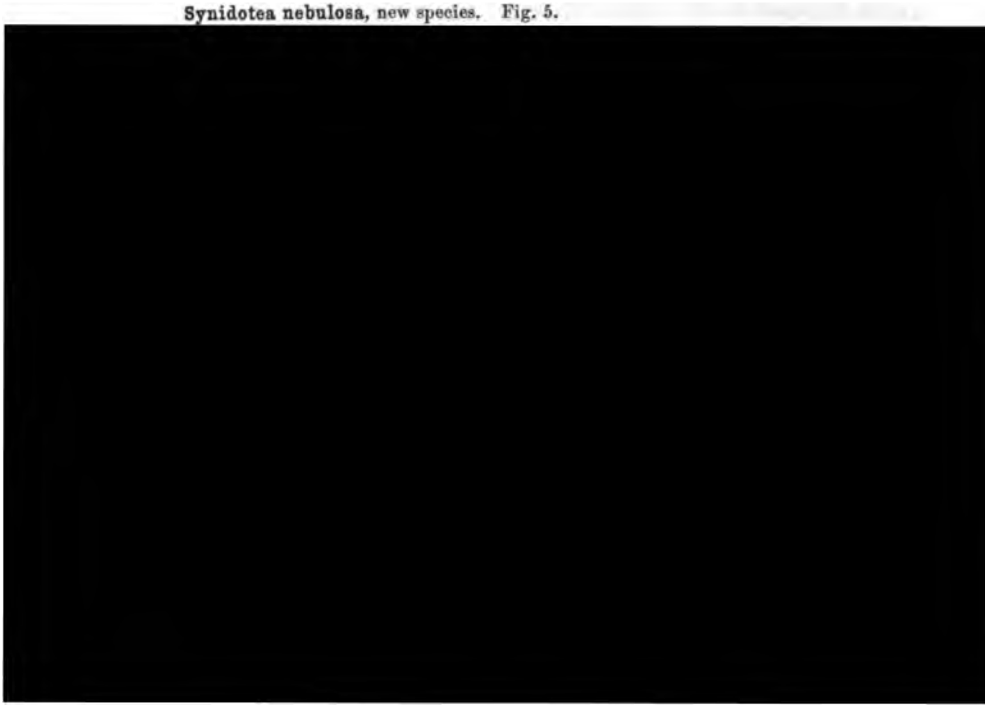
The feet are sparsely set with coarse hair. The valves of the operculum are diagonally crossed by a curved line.

The specimen is clouded with dark patches made up of small black spots.

This species can be distinguished from any other yet described by its broadly emarginate abdomen.

Length 17 mm., width 7 mm. (No. 20,504, U. S. N. M.).

Synidotea nebulosa, new species. Fig. 5.



length in a large specimen and have a ten-jointed flagellum; the distal joint of the peduncle is 1.5 mm. in length. The outline of the thorax is ovate in both sexes; the undulations are distinct; the fourth segment is the longest. The epimeral sutures of the three posterior segments can be made out under a lens. The incisions on the sides of the abdomen are short; the areolations at the base and summit are large and smooth. The lateral outline of the anterior half is straight or slightly concave, of the posterior half convex. The distal end is slightly excavated.

Several specimens of both sexes were taken at Station 3,600 in company with *S. picta*, and at Station 3,637 in 32 fathoms. Mr. Dall obtained them at Unalaska in 16 fathoms; at Kyska Harbor, 9 to 16 fathoms; Semidi Islands, 12 to 25 fathoms. Types (No. 20,503, U. S. N. M.) from Station 3,600, lat. N. 55° 06′ 00″, lon. W. 163° 28′ 00″, 9 fathoms.

This species can be distinguished at sight from all other alcoholic specimens of the genus by its dark-colored head and fourth segment, and by the dark line surrounding the elevated portions of the abdomen. The first and last three segments of the thorax are light with small flakes of black uniformly sprinkled over the surface; the median line of the first three is usually broad and dark.

Length of a large male, 17 mm.; width, 6.5 mm. Length of a large female, 15 mm.; width, 7 mm.

Synidotea angulata, new species. Fig. 6.

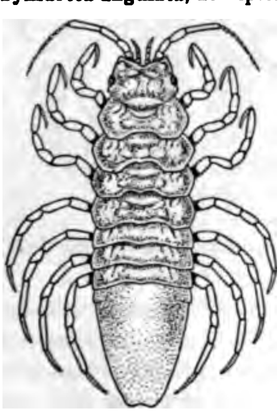


Fig. 6. *Synidotea angulata* Benedict. x $\frac{4}{1}$.

This is a small species easily distinguished from the others of the genus in its region by the angular and projecting lateral margins of the first three thoracic segments; it is most nearly related to *S. nebulosa*.

The head is excavated in front in a nearly even curve, and there is no distinct median notch as in *nebulosa*. Between the eyes and the front the tubercles are very low and inconspicuous; the cross areolation is a low ridge interrupted in the middle by a V-shaped notch; the lateral areolations of other species, in this, form a single transverse areolation not at all separated in the middle; it is separated from the postcephalic lobe by a deep impression. The sides of the head

do not extend to the vertical line of the eyes. The flagellum of the antennæ has nine or ten joints. The sides of the thorax are very much less arcuate than in *nebulosa*, and where in the latter species the margins are rounded, in this they project in obtuse angles; the lateral margins of the three posterior segments are straight. The abdomen is very much as in *nebulosa*. In color this species in part simulates *nebulosa*. In the specimens examined it lacks the black flakes, there is a line of spots near the margin and one in line with the epimeral lines.

The largest good specimen is 11 mm. in length.

Stations 2,868, 2,869 and 2,872, in 31 to 38 fathoms.

Station 2,869, lat. N. 47° 38′ 00″, lon. W. 124° 39′ 00″; 32 fathoms. Types (No. 20,506, U. S. N. M.).

Synidotea pallida, new species. Fig. 7.

The frontal margin is deeply and evenly concave, there being no median notch. The surface between the eyes is protuberant and is divided by a slight median impressed line. In the angle formed by the raised portion between the eyes and the horizontal front are two horn-[redacted]

tubercles; the median line is also tubercular. The legs are long and slender on the 7th segment, a little shorter on the 6th, and so on to the 1st which are quite short.

The abdomen is markedly narrower than the 7th segment, it tapers gradually to a point near the end which is broad and well rounded, the median line ends in a small concavity best seen with a lens. Excepting the usual lateral incisions, the upper surface is smooth and glabrous.

A large male measures 22 mm. in length and 7.5 in breadth; a female, with eggs, 12 mm. in length and 4.5 in breadth.

Not less than one thousand specimens of this species were dredged off Chirikoff Island, Alaska, at Station 3,340, lat. N. 55° 26′ 00″, lon. W. 155° 26′ 00″, 695 fathoms (No. 20,500, U. S. N. M.).

Synidotea erosa, new species. Fig. 8.

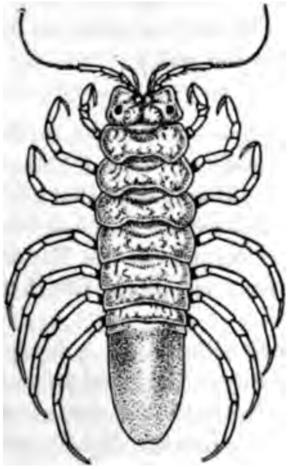


Fig. 8. *Synidotea erosa* Benedict. x ⅞.

Several specimens of this species were dredged at Station 3,210 off Sannakh Islands, Alaska, in 483 fathoms; lat. N. 54° 00′ 00″, lon. W. 162° 40′ 30″ (No. 20,505, U. S. N. M.).

Erosa is more nearly related to *S. pallida* than to any species yet discovered, as in the latter there are two horn-like protuberances just back of the frontal margin. The cephalic suture is the same except that it is more open at the bottom. The other protuberances and depressions of the head are the same, except that in *erosa* there is a prominent tubercle between the eyes and the front; in *S. pallida* this is lacking, or, if represented at all, by a low swelling. All of the projections of the head are more or less eroded. The segments of the thorax have very low tubercles or slight swellings where the spines are situated in *pallida*. The rugæ of the lowest portions of the thorax are much more prominent in this species. In outline *erosa* is narrower and less arcuate, the outer margins of the segments are much less produced. The 7th segment is not noticeably wider than the base of the abdomen. The abdomen holds its width to a point beyond the middle, whence it is rounded to the terminus, which, as in

pallida, is slightly concave. The slightly arcuate outline of the thorax running into the straight outline of the abdomen differentiates this from all other species of the genus. Other differences are, the larger eyes situated nearer the margin of the head, the very hairy edges of the valve, and the sparsely granulated abdomen. The length of the adults from which the foregoing description is made ranges from 21 to 22 mm.

A female, about 14 mm. in length, has arcuate lateral margins, and all of the tubercles of the large male are exaggerated in size; the tubercles between the eyes and the front and the pair separated by the median line form a row of four large tubercles on the front.

The young males have almost parallel sides; the median tubercles of the front are swollen and much eroded, as are all of the prominences of the head. On each of the first four segments of the thorax is a median tubercle on the transverse ridge and also a smaller one in front of it; there is another row of tubercles on the sides. The sides of the abdomen are rough and warty.

Synidotea nodulosa (Krφyer).

The limits of this species are hard to define. All of the species with pointed abdomens are very similar, yet constitute, I believe, good species. Abundant material will not unlikely show that additional species must be recognized. Krφyer described *nodulosa* from South Greenland; Harger had several specimens from the Eastern [redacted]

ous than those of the Jugor Schar specimen, the posterior one on the median line is the largest and is not so positively united at the base; the areolations behind the cross are not so elevated, and are but faintly punctate; in this and in some smaller specimens they are united on the median line; the tubercles in front of the eyes are not so nearly vertical and are much more angular; the transverse ridges are not so large but more acute, with slight tubercles at their intersection with the median line. The abdomen measures at its base 3.2 mm. in breadth, its length is 4.25 mm. In *S. lævis* the cross is armed with but a single tubercle on the median line; this is not vertical as in *nodulosa*, but horizontal, and when seen from above covers the median notch of the front, otherwise the cross is a smooth areolation with slightly elevated transverse extremities. The areolations behind the cross are smooth and broadly united at the median line. The tubercles in front of the eyes arise from the margin and form a part of it. The segments of the thorax are inconspicuously tubercular on the median line. The breadth of the abdomen at the base is 4 mm., length 5.4 mm.

Synidotea lævis, new species. Fig. 9.

Numerous specimens from Stations 3,252, lat. N. 57° 22′ 20″, lon. W. 164° 24′ 40″, 29½ fathoms, and 3,253, lat. N. 57° 05′ 50″, lon. W. 164° 27′ 15″, 36 fathoms, respectively, differ from *S. nodulosa* and its near allies by the lack of three tubercles on the head and the less prominent elevations of the thorax. The cross-like areolation between the eyes is smooth with the exception of a single tubercle which is prolonged horizontally over the median notch. The tubercles which in *nodulosa* arise between the eyes and the front, in this species arise at the margin and form a part of it. They are less erect than in *nodulosa* and are more angular.

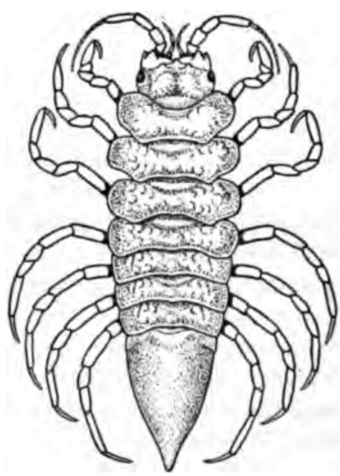


Fig. 9. *Synidotea lævis* Benedict. x $\frac{4}{1}$.

Harger says of *nodulosa*, "Color in alcohol gray, often with brownish transverse markings;" these specimens are gray in alcohol with a dark, broken, median line on the anterior segments.

Length 15 mm., breadth 4.8 mm. Types (No. 20,501, U. S. N. M.).

Synidotea muricata (Harford). Fig. 10. *Idotæa muricata* Harford. Proc. Cal. Acad. Sci., VII, Pt. I, p. 117, (1876), 1877.

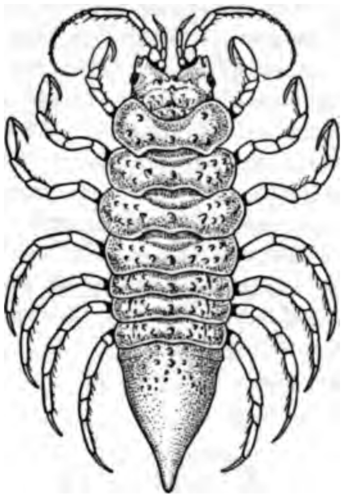


Fig. 10. *Synidotea muricata* Harford. x 2½.

Six specimens, taken by the 'Corwin' off Icy Cape differ from all other species of the genus yet described by the spiny nature of the dorsal surface, head and pleon included. The locality is lat. 70° 15′ 00″ N., long. 162° 55′ 00″ W., in 25 fathoms.

The head is deeply excavated in front, the margin running inward from the lateral prolongations to a median notch. The flagella of the antennæ have from 10 to 12 segments. A small spine overhangs the median notch, a second spine is situated a little behind the first, a third is in line on the posterior lobe; two other spines, one on each side of the first two, form, in connection with them, the figure of a diamond; the spines of the median [redacted]

Synidotea picta, new species. Figs. 11 and 12.

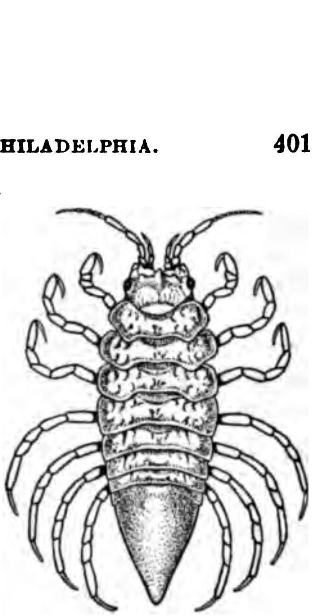


Fig. 11. *Synidotea picta* Benedict. x $\frac{4}{1}$.

The head is deeply excavated in front; the notch is deep; the tubercles in front of the eyes are near to and overhang the margin.

The median line of the cross areolation is elevated into a wedge-shaped ridge which overhangs the notch in a vertical view; the transverse extremities of the cross are elevated forming tubercles; the lateral areolations are protuberant and are separated by a deep depression which unites with the depression in front of the postcephalic lobe and the one behind the cross, altogether forming a B-shaped depression. The elevated portions of the head are pitted. The flagellum of the antennæ is composed of eight or nine segments. From the anterior angles the body widens to the fourth segment; from this point it diminishes evenly in size to the end of the abdomen. All of the segments have low swellings on the median line and numerous rugosities on the sides. The extremity of the abdomen is pointed; the surface is punctate.

Fig. 12. *Synidotea picta*, var. x $\frac{4}{1}$.

This species is beautifully colored; the antennal peduncles are patched with dark, the anterior margins of the head are in some specimens blotched with rose; the rugosities of the thorax are tinged with red, the abdomen is blotched with red and dark. In the more highly colored specimens the lower portion of the segments are light and red, except on the fourth which is always dark. The legs have a patch of dark on each joint.

The length of a large specimen is 14 mm.

The seven type specimens were dredged at Station 3,600, lat. N. 55° 06′ 00″, lon. W. 163° 28′ 00″, 9 fathoms, in company with *S. nebulosa* (No. 20,502, U. S. N. M.).

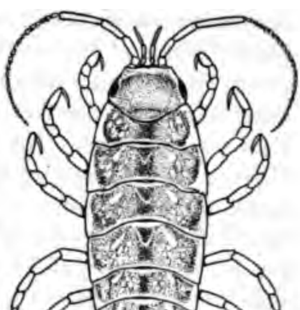
Variety.—Specimens obtained by Mr. Dall in Bering Strait (No. 13,311, U. S. N. M.).

and at Cape Lisburne (No. 13,325, U. S. N. M.) and by Lieutenant Stoney in Norton Sound (No. 13,641, U. S. N. M.), differ from the types in having a stouter abdomen and a much more solid shell; they also lack color, not unlikely because of the greater length of time in alcohol. These specimens come from localities far to the north of the station where the types were obtained. More material in a fresh state may show sound lines of demarcation that are not sufficiently evident in the material at hand.

Synidotea harfordi, new name. Fig. 13.

Idotæa marmorata Harford, Proc. Cal. Acad. Sci., VII, p. 117, 1877.

The name given by Mr. Harford was preoccupied by Professor Packard in 1867. (See p. 392).



The front of the head is nearly straight, the sides are bent abruptly downward and inward; the eyes are on the angle thus formed, extending the range of vision to objects beneath. The length of the antennæ laid off on the median line reaches from the front to the middle of the sixth thoracic segment; the fifth joint of the peduncle equals in length the third and fourth [redacted]

Synidotea hirtipes (Milne-Edwards).

Idotea hirtipes Milne-Edwards, Hist. Nat. des Crust., III, p. 134, 1840. Krauss, Die Sudafrikan. Crust., p. 61, 1843.
Edotia hirtipes Miers, Jour. Linn. Soc. Lond., XVI, p. 68, 1883.

Miers' description of Milne-Edwards' type is as follows:

"In this species the body is somewhat ovate, moderately convex, arcuated on the sides, evenly granulated above, with large inequalities on the sides of the thoracic segments at some distance from the lateral margins. Head with the anterior margin very slightly excavated, and with a semicircular curved impressed line posterior to its frontal margin, and another, nearly straight line near its posterior margin; its antero-lateral angles prominent and nearly right angles. The first three thoracic segments with an impressed curved line in the middle of the dorsal surface, and rounded at their postero-lateral angles; in none of the segments are these angles prolonged backward. Postabdomen short, rounded posteriorly, with a fissure on each side at its base, and with a small and shallow median emargination at its distal end. Eyes large. Antennules reaching nearly to the end of the penultimate joint of the antennæ, with their basal joints very small. Terminal joint of the peduncle of the antennæ longer than the preceding; flagellum with about 14–21 joints. Legs long, slender, hairy, and terminating in a long claw. Terminal plates of the opercular valves irregularly four-sided, being much narrowed at the distal end. Length of the largest specimen nearly 1 inch (25 mm.), breadth nearly $\frac{5}{12}$ inch (10 mm.)."

Localities, Cape of Good Hope (Types); Simon's Bay, South Africa, in 4–7 fathoms.

Synidotea lævidorsalis (Miers).

Edotia hirtipes, var. *lævidorsalis* Miers, Jour. Linn. Soc. Lond., XVI, p. 69, pl. III, figs. 1, 2, 1883.

Miers says of this species "Two males are in the collection of the Museum from Jatiyama Bay, Japan, obtained at a depth of 6½ fathoms, lat. 39° 2′ N., long. 189° 50′ E., presented by Dr. J. Gwyn Jeffreys and collected by Capt. H. C. St. John, R. N., that differ so slightly from *I. hirtipes* that I cannot regard them as specifically distinct. The body is quite smooth in the larger example, and very nearly so in the smaller (which is of larger size than any specimen of the typical *I. hirtipes* that I have seen), and in both is of a decidedly narrower-oval form; the antero-lateral angles of the head

are perhaps not so prominent and more rounded; the eyes are smaller. Length of the largest example about 1 inch, 1 line (28 millim.); breadth about $\frac{5}{12}$ inch (10 millim.). In this specimen the flagellum of the antennæ is about 30-jointed, but in the smaller example (length $\frac{5}{6}$ inch, 21 millim.) only about 21-jointed."

GEOLOGICAL SECTION FROM MOSCOW TO SIBERIA AND RETURN.

BY DR. PERSIFOR FRAZER.

The accompanying notes were made during the excursion to the Ourals which was arranged by the local committee for a certain number of Geologists before the business session of the Seventh International Geological Congress at St. Petersburg. In addition to the complete preparations for the expedition, carefully edited brochures of its different parts were printed by those Russian geologists who had devoted especial study to the districts. So far as the excursionists were concerned the section was necessarily one of inspection and verification of what had been done, rather than one of exploration for the establishment of new facts, and consequently, in a description like the following, the data secured in the years of long and patient investigation by the Geological Survey of Russia have been used so far as this epitome required them.

The lessons learned by the numerous, long and well planned excursions made in connection with the Congress, begin appropriately with the study of Moscow and its environs, for here many of the geological stages which form the most important points of orientation in the study of south-eastern and middle Russia are well developed and have been thoroughly investigated by numerous geologists.

In general terms Moscow is a city of very large area occupying a number of hills from 400 to 500 ft. above the average water level, which latter, at the southern boundary, is 348 ft. above the ocean. The hills are cut out of the boulder clay and morainic sand, the Cretacic, the Jura-Cretacic, (or Volgian), and the Jurassic down to the middle Carbonic (or Muscovian), on which the latter rests; by the Moskowa, the Yaouza, the Néglinnaia and their little tributaries. The lowest Mesozoic rocks overlying the Carbonic are of Middle Callovian age, and in the eastern part, of the government of Moscow they rest on the upper Carbonic rocks, chemically more altered than the Muscovian which form "the rocky base on which the ancient capital is built." [See Livret Guide, I.]. Borings undertaken to find artesian water in the Devonic have revealed

the following measured section from the summit of one of the hills 473 ft. above water level.

	Feet.
Argilo-arenaceous Quaternary and Mesozoic, ...	70
Middle Carbonic (Muscovian) limestones, ...	592
Lower Carbonic limestones, ...	243
Coal bearing Argilo-arenaceous stage of the same horizon,	161
Devonic limestones and Marls, ...	438
Total, ...	1504

The bottom of the bore hole was left in the horizon last mentioned.

Briefly stated the middle Carbonic or Muscovian of the vicinity of Moscow is typical of this stage, containing many fossil forms of which half are identical with those found in lower beds of the Carbonic of western Europe, while others have been found for the first time in the Muscovian.

The Jurassic fauna is practically in perfect accord with that of western Europe, except that the Sequanian is not suspectible of differentiation and the Kimmeridgian is petrographically and stratigraphically confounded with the overlying Volgian.

On the question of the Volgian appears the first of several subjects of debate among the Russian geologists. The author of the brochure (L. G., I.) M. Nikitin thus defines the Volgian to which [redacted]

Europe, and prefers not to attempt its division between the upper Jurassic and the lower Cretacic until a great deal more work has been accomplished. Bogoslovsky terminates the upper Volgian at the horizon *Olcostephanus nodiger* which he considers the uppermost limit of Jurassic as that of *Hoplites Rjasanensis* is of the Neocomian and the bed *Olc. polyptychus* and *Olc. hoplitoides* the principal lower bed of the Neocomian.

Pavlov, while accepting the succession of the others, classes the entire Volgian group with the Jurassic, adding also a part of the Neocomian of western Europe.

With this preliminary glance at the formations in the vicinity of Moscow, we were prepared to enter upon the first of the great excursions, or that to the Ourals. The start was S. E. down the Moskwa on the Moscow-Riazan Railway, which runs over the lower arenaceous member of the boulder clay or the eluvion which was laid down upon it after the erosion of the morainic upper part. To Bykowa the cuts and pits show white stratified sands belonging to the upper Volgian. S. E. of Lioubertzy the surface of the hills is said to be formed of sands and sandstones, partially modified to quartzite containing ammonites typical of the zone of *Olcostephanus nodiger* and *Oxynoticeras subclypeiforme*. The lower Volgian is found at Miatchkowo resting on gray and black stratified clays with intercalations of dark brown argillaceous, combustible schists, 28 to 33 ft. in thickness, corresponding in general to the Oxfordian and Sequanian. M. Nikitin was led to conclude from a study of this series that at least in central Russia there exists an intimate connection between the beds of *Cardioceras cordatum* and those of *C. alternans*, which appears not only in the continuation of the greater part of the conchifers and gasteropods from one horizon to the other, but also in the gradual change and passage of some forms of ammonites and other species [L. G., II.]. This conclusion is of the greatest importance to the student of the Jurassic in Central Russia.

Pursuing the route through the government of Riazan along the river Pronia, the lower Volgian and upper Jurassic representatives are seen to disappear so that the horizon *Hoplites Rjasanensis* rests successively, first on the Oxfordian and later, near the town of Skopine, on the Callovian. The Carbonic limestones also show gradually descending outcrops from the lower stages of the Muscovian, through the different levels of the lower limestones of

Productus giganteus and finally to the lower coal in the neighborhood of Riajsk and Skopine. The quaternary boulder clay of this region contains large blocks of crystalline and quartzitic rocks from Finland. All these quaternary deposits of this region are covered by a dark brown or black soil, which the Russian investigators agree to divide into two classes. 1st. the "tschernozem" properly so-called, which is dark brown or black, 0·5 meter or more in thickness, rich in humus, lime and zeolites, formed in place by the alteration of various superficial deposits, etc.

2. Forest earth, also dark brown or black, but of different physicochemical constitution.

It may be true, however, that the tschernozem of the steppes when covered by forests is gradually transformed into forest earth. These two kinds of soil and the resulting steppe and forest alternate in the region between the Pronia and the Volga. The line of route from Riajsk through Pensa to the neighborhood of Syzran follows the great trans-Siberian railway over upper Cretacic and lower Tertiary steppes of moderate glacial interest, and considerable monotony, but at the latter place there is an abrupt change.

About 760 km. from Moscow by railway, or 1,400 km. from the head-waters of the Volga not far from St. Petersburg, a sudden change in the landscape and surroundings on close approach to the great river indicates that some special forces have been at work in [redacted]

has been elevated. In the depression of the river Syzran the deposits of the Caspian have been laid down. Following the Syzran River down stream over its easterly course to join the Volga, one sees to the south of the fault the successive appearance of ever older measures, from the upper through the lower Cretacic, the Volgian, the Callovian, and, finally, near the town of Syzran, the upper Carbonic. The railway runs along the heights commanding the town of Syzran, which consist of Jurassic and Volgian, but as soon as it has passed that town it descends and runs along the right bank of the Volga, on the terrace of these formations resting on the Carbonic limestone, to the village of Batraki, south of the Samarskaia Louka. Thence a short distance down the Volga ($\pm$ 15 km.) one reaches Kashpour. On the hill of this name one sees in succession downward from the top various horizons of the Cretacic, the Volgian, and finally the river deposits. Above Batraki, a less distance, one comes to the great bridge of the trans-Siberian railway across the Volga, 1,485 meters long, on twelve piers, and estimated at 150 ft. above the river. At the abutments the Carbonic deposits are compact limestones more or less dolomitic, containing *Fusulina* and saturated with asphalt as at Syzran.

The orographic feature of the approach to Syzran is the elevation caused by the fault passing north of the Samarskaia Louka, at the great bend of the Volga. The part of this elevation at and west of Syzran is called the Syzran Mountains, that of the nucleus of the peninsula the Jegouli, and on the opposite or left bank of the river, the Mountains of Sok. The main mass of these mountains is composed of Permian-measures; but in the neighborhood of Samara, as at Samarskaia Louka, deposits with shells of *Cardium*, *Corbicula* and *Hydrobia* give the impression that these are the remains of the the Caspian basin. The terrace clays are distinctly laid on the Permian, but the Caspian sediments which are only of insignificant thickness, are found in detached islands, and may be seen far up on the heights of the Volga throughout the whole course from Kashpour. The upper beds of the Permian at Samara are compact limestones with intercalations and masses of gypsum and silex, which have made the construction of the railroad bed very difficult in places on account of the tendency to landslides. The lower Permian beds, oolitic in places, are rich in lamellibranchs, gasteropods and brachyopods characteristic of the Permian.

Below, there is a cavernous brecciform limestone formed of fragments of limestone cemented together by calcareous matter, but without fossils. It is about 83 feet thick, occurs about 4 kilom. up the Volga from Samara, and forms a large part of the upper part of the Mountains of Sok. Some kilometers before reaching the confluence of the Volga and Sok the Carbonic limestone shows itself beneath the brecciated limestone in the sandy beds as in the mountains of Jegouli. The upper horizon shows *Schwagerina* limestone. Separated from the Sok Mountains by the valley of that name is the mountain or hill called Tzarev-Kourgan (Hill of the Tsar). It shows in descending order from the top: Limestone with *Fusulina longissima* and other Fusulinas, *Spiriferina Taranæ*, and *Productus Villiersi*.

(*d*) Limestone with *Bellerophon*, large, as yet undetermined *Spirifers*, *Nautilus*, *Orthoceras*.

(*c*) Dolomites with *Productus Cora*.

(*b*) Limestone of *Productus scabriculus*, *Camarophoria crumena*, *Meekella eximia*.

(*a*) Limestone of corals and bryozoans.

The Hill of the Tsar is thus formed by the same limestones as those constituting the greater part of the Jegouli, and like that of the fauna of gshélien age near Moscow.

The long distance from Samara to Oufa over the trans-Volgian steppes is over the Permo-Trias and the Permian. The modelling [redacted]

caps the beds of Zechstein fauna, and the other lies below the Zechstein, corresponding in part with its lowest horizons.

As approach is made to Oufa one after the other of the distinguishing beds in the two formations rises slowly and loses itself farther east on the tops of the nearest hills. The gray group of schistose limestone and marls intercalated with friable sandstone marking next to the uppermost member of the Permian, recognized by the Russian Survey, shows itself for the last time on the summit of Yarych-Taou, the last of the conical mountains of erosion along the Dioma. The appearance of a red group in the sections near Oufa has caused many geologists to ascribe this horizon to the Tartarian, which the geologists of the survey hold to be an error, maintaining that the ravines and sections establish beyond doubt that the measures increase in age as one goes eastward.

Oufa may be properly said to lie on the line which marks the foot of the Ourals, because at about this distance from the axis of the Oural chain the streams having broken through the west flanking foot hills of the main chain take the final courses to fulfil their ultimate destiny of irrigating and fructifying the trans-Volgian steppes.

The Permian plateau on which Oufa stands is cut by three rivers: the Oufa, the Sim, and the Biéleia, into three elevated plateaux separated by deep and rich valleys. The immediate neighborhood of Oufa has not furnished distinctive fossils, but the sections along the Biéleia and its affluents have convinced the geological surveyors that the upper part of the section at Oufa corresponds with the lower Permian red bed which is capped by the gray arenaceous Zechstein bed, richly furnished with fossils that can be seen in the sections of Slak, the mountains Yarych-Taou, etc., between Samara and Oufa. The lower gypsiferous and calco-gypsiferous bed at the base of the Oufa section can be seen to have intimate relations with the gray, compact, tile-like limestones, and dolomites, and the cavernous, spotted brecciform limestones containing many casts of *Bellerophon*, remains of *Productus* and *Orthoceras*, accompanied by *Schizodus truncatus*, *Astarte Permo-Carbonico*, *Macrodium kingianum*, and corresponds to the lower Zechstein of southern and central Russia, situated below the lowest bed of Permian red. [See L. G., III.]

As an aid in understanding the orography of the western half of the Ourals (from which the eastern half is entirely different) let it be

borne in mind that the westward flowing streams usually have their origin in extensive marshes and bogs lying in the elevated parts of the longitudinal valleys, and covering many square wersts[1] or kilometers. The first part of their course, or that more or less on the line of the meridian north or south, is usually rapid and tumultuous. In their middle course they take a sudden change in a direction at right angles to their final course and descending with the same rapidity cut through gorges ten wersts or so in length with abrupt and sometimes vertical walls 100 meters and more in height.

Having passed the westernmost rocky barrier the rivers flow sluggishly through large alluvial valleys in which rock in place is rarely seen, and the affluents of the larger streams are few and small. These valleys are filled with the remains of ancient river and lake beds, and show distinctly alluvial terraces.

Having brought the section to the lower Permian spotted limestones and dolomites the further journey east reveals a series to which the name Permo-Carbonic has been given.[2]

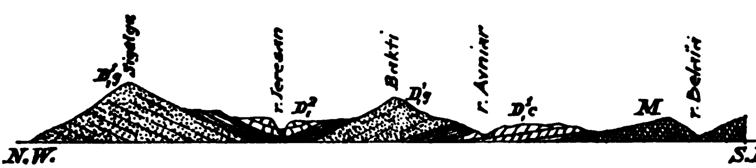
This band separating the two groups is divided into an upper or calcareo-dolomitic, and a lower member called the horizon of Artinsk. This latter contains sandstones, limestones, marls and various schists. Karpinsky, Kratow and Tschernischew have shown that it is characterized by original ammonitides of great interest since the discovery of similar forms at Darvas in Sicily, in Texas, and other places. It contains brachiopods also, of which the study has

[redacted]

development of its limestones and marls in innumerable swellings or lumps of various sizes from a few inches to a few feet in diameter, which on examination prove to consist either of concentric cabbage-like layers, or of irregular foliations like the bent leaves of a book.

The immensely important conditions which follow from the acceptation of the Russian Survey's determination of the relations of the rocks forming the Oural-Taou, or main chain of the Oural, makes it desirable to consider it a little more attentively.

The Oural-Taou, or main chain, and water-divide of those mountains is formed of crystalline schistose rocks, which are in *intimate connection* with deposits of indisputable paleozoic age, and which themselves are nothing but modified paleozoic rocks. This is the terse summing up of the thesis [L. G., III, 12], and the argument is contained in the ideal section (ib., p. 11), in which the lower Devonic member is shown to be a quartzite lying in a synclinal between schists and limestones above and below; and the lower of these limestones is stated to contain no fossils by which its age can be definitely ascertained in the northern Oural region. But in the South Ourals it contains an extensive fauna described by Tschernischew.



Section from the Zigalga to the Avniar

(from Livret Guide III. p11)

FIG. 1.

- D^2_1 Limestone. Upper stage of the Lower Devonic.
- D^1_1 g Quartzose sandstone and schists.
- D^1_1 c Limestones.
- M Metamorphic schists and quartzites.

The section representing the views of the Russian Geological Survey as to the structure of the Oural chain is seen in L. G., III, p. 11, and is thus described by M. Tschernischew:—

"The most instructive section of the lower Devonic of the south Ourals extends south of the line of railway, from the chain of

Zigalga to Avniar transversely to the direction of the Zigalga and of the Bakti and crossing the rivers Yourezan, Avniar, and Biéleia. This section shows the principal mass of the bed of quartzose sandstone D^1_1 g between two schistose beds of which the lower rests directly on the oldest limestones D^1_1 c of characteristic fauna. The predominant rock of the lower schistose bed is a black sericitic schist reflecting on its steel-gray surface, sometimes a silky lustre. Quite often is observed the passage of these schists into micaceous and chloritic varieties, very rich in magnetite and hematite. Taking up quartz these schists pass into micaceous and talcose quartzites. In places the black argillaceous schist shows inclusions of large pyrite crystals, and pseudomorphs of pyrite in limonite."

'This black schist is associated in the lower part of the bed D^1_1 g with a serecitic schist nearly of the same composition as the black, but poorer in carbonaceous matter and consequently of a lighter shade.'

'After a certain amount of practice it is easy to distinguish the lower schists, situated under the horizon of quartzites and sandstones, from the schists which surmount this horizon. The latter of very variable color, structure, and composition never have this reflexion on the plane surface but they pass also, though very rarely, and in exceptional cases, into chloritic and ottrelitic schists. Their color, sometimes banded, varies between dark gray almost black, yellowish, greenish, and reddish gray. Marly sandstone, marls, and limestones [redacted]

chew is distinguished by a great variety of forms; *i. e.*, numerous remains of ostracodes, cephalopods, *Platyceras*, representatives of *Hercynella* (*H. bohemica*), and peculiar conchifers (*Vlasta Dalila*)."

In the section this limestone apparently rests conformably on the group "M" of metamorphic schists and quartzites, which is thus assumed to be of lower Devonic origin.

The lower division of the Devonic is thus described (l. c., 10):

"It has great petrographic diversity. The varieties most developed include quartzose sandstone without feldspar, arkoses and conglomerates. These are the rocks that form the ridges of the most considerable parallel chains of the South Oural. In the eastern summits is observed a gradual transition from sandstone, arkoses and conglomerates, to compact quartzites, charged more or less with mica. The lower schist is a black sericitic schist, giving a steel gray sometimes silky reflexion on the surface. Frequently the passage of these schists to micaceous and chloritic varieties, very rich in magnetite and iron oxide, can be observed. Taking up quartz these schists pass into micaceous and talcose quartzites. In places the black argillaceous schist shows inclusions of large crystals of pyrite and pseudomorphs of pyrite in limonite. This black schist is associated in the lower part of the bed D_1^1 g with a sericitic schist nearly of the same composition as the black, but poorer in carbonaceous matter, and therefore of lighter color."[3]

"The rock most largely developed in the underlying group M is a mica schist composed of quartz and mica, to which is ordinarily joined a greater or less quantity of chlorite and magnetite. The element of greatest interest in these mica schists, and chloritic mica schists, is the orthose, which occurs in irregular and often broken fragments. Very often these are enclosed in grains of quartz or mica. Indications of the substitution of quartz and mica abound in the cleavage of these orthoses. Tourmaline, and in the neighborhood of Slatooust, garnets and staurotide are the most frequent inclusions in the mica schists."

"Besides these schists the crystalline region comprises M a series of argillo-schistose rocks which show the transition of typical phyllites into the clastic argillaceous schists of the lower Devonic. The massive rocks of M are represented only by granites and diabases. Among the granites can be distinguished the gneisso-granites and the coarsely crystalline porphyritic granites resembling what is called Rappakiwi from Finland, which is much used for building, and forms

[3] See preceding page.

the pillars of St. Isaak's as well as the parapet of the Neva within the city of St. Petersburg.

Such is the veriest skeleton outline of the facts of structure stated by M. Tschernischew in L. G., III, and which he illustrated by the nine days of excursions between Oufa and the crest or median line of the Ourals. A point of the greatest interest, but connected with the structure at the uppermost extremity of the scale must not be forgotten for it constitutes a lesson of the trip second in importance to no other. It is in effect that the explorations of the river terraces of the Biélaia leave no doubt of the relations between the upper terraces and the post pliocene deposits of the Caspian sea invasion. The conclusion is that these upper terraces belong to an epoch, when the Caspian Sea played the part of a dyke which brought about the raising of the level of the Kama, the Biéleia and their affluents with the consequent decrease of the rapidity of their currents and therefore of their erosive force. In proportion to the retreat of the Caspian sea, the erosive power of the rivers must have augmented, from which resulted the narrowing and deepening of these beds and the formation of terraces. This latitude is about that of the northernmost deposits, attributed to the former Caspian Sea, (57° North), while the southernmost similar formation ascribed to the action of the White or Northern Sea lies approximately on lat. 61° North, leaving 4° or about 440 kilometers (273 miles) in which the traces of neither sea have been [redacted]

examination of the rocks from Miniar to Simskaia. The cliffs were made up (counting from the base) of lower Devonic limestones (D_2^1), the limestones and dolomites (D_2^2), the *Spirifer Archiaci* limestones (D_3), and the lower Carbonic limestones C_1. Below the Miniar works the D_2^2, limestones show in places the cabbage structure. About the mouth of the Kalosleika the lower Carbonic limestones crop out containing an abundance of foramenifera, (*Eudothyra parva*, *Fusulinella Struvii*, *Archædiscus Karreri*, and fragments of *Productus striatus* and *Chonetes papilionacea.*) The borders of the lake of Simsk offer a classical section for the study of the deposits of Artinsk, and Carbonic sediments.

The journey was continued up the valley of the Eralka and down the valley of the river Berdiach, still in the deposits of Artinsk. At the (Baschkir) village of Yakhia the Carbonic limestones are again met.

These show themselves all along the route to Oust-Kataw, where the fossil remains are very abundant.

Between Oust-Kataw and Wiazowaia the same Devonic series is several times repeated. At Wiazowaia the railway was left and a section was made in droschkes to the mines of Bakal. The succession D, D_2^1, D_2^2, is thrice repeated between Wiazowaia and the village of Perwoukhina the highest crests being formed of the first named bed, which, two faults successively raise. It is in these three mountains Chouida, Irkouskan and Boulandikha, (all of lower Devonic), that the very rich iron ores of Bakal are found. They have been worked for a century and a half but as yet and for a long time in the future the work has been and will be done in open cuts. The variegated quartzites and quartzose schists are cut by dykes and massives of diabase.

The mineral masses of Hematite and Siderite are exclusively found in the middle member of the above series or the variegated schists where they are sometimes 40 meters and more in thickness. Besides this the minerals show themselves sometimes in pockets. A glance is sufficient to show the intimate connection between the dolomitic limestones and the mineral deposits. One can follow step by step the transition of the limestones into spathic iron and that into hematite. When the mines were first exploited only Hematite was found at a short distance from the surface, since then in proportion to the depth of the workings spathic iron has been found with passage into dolomitic limestone. The mines of Bakal and Satkinsk

were examined and the return to the railway was made at the station Souleia over Devonic measures.

From Souleia to Slatooust the upper divison of lower Devonic D^1_2 is passed over as well as D^1_1. Near the station Berdiaouch the dolomites D^2_2 are seen with thick dykes of porphyroid granite intercalated among them and resembling the Finland Rappakiwi. Between Berdiaouch and Toundouch the line pursues the horizon of the Devonic limestones and dolomites, showing frequently the foliated structure below described.

Finally a complex succession of rocks begins at the village of Medwediova containing limestones, schists and argillaceous and sericitic sandstones, mica schists, diabases, amphibolites and gneiss, all thrown into folds of high dip and penetrated by faults. The mutual relations of the massive rocks, crystalline schists and the quartzites of Ourenga and Kossotour are clearly seen in the sections near Slatooust. This town lies in a picturesque valley of the river Ai. The Kossotour and Ourenga heights which border it, on the north and south respectively are similarly composed and are parts of the same orographic unit.

Under the leadership of Mr. Tscherneschew, Kossotour was reached by a brisk walk through the woods from the station of Slatooust and sections were made along the river Ai, showing coarse grained mica schists and amphibolite, containing large Garnets, [redacted]

cut is about 400 ft. long with two sigmoid curves. One hundred and fifty feet from the northeast end a very much decomposed grayish layer occurs containing Garnets, some of them flattened on the planes of bedding. About 75 ft. from the northeast extremity a mass of white quartz occupies a large space and penetrates to the surface of the cut above, embedded in the mica schist. Another mass of white quartz strikes across the railway, south 20° west, mica schists follow this to the end of the cutting.

The next object of study was the Bolchoi Taganai (or Great Taganai). There are three mountains called Taganai, viz: Bolchoi (or great), Srédny (or medium) and Maly (or small) north of Slatooust, which are connected together and with the Oural-Taou or main chain and water-divide by high plateaux. They are separated from the north flank of Kossotour by the valley of the river Bolchaia-Tessma.

All of these heights are composed similarly of a quartzite summit overlying a friable sandstone with kaolinized Feldspar, and this latter resting on garnetiferous mica schist with subordinated limestones. The dips being to the north-west, faults with a southeast hade repeat this succession, three times, the easternmost repetition, being the lowest but the most extensively developed and formed by the chain Oural-Taou. On the east side the heights are abrupt precipices, but on the west they are gently inclined and accessible.

The river Kiolim, which traverses the Ourals and forms part of the Siberian river system, descends this divide to the north, the river Tessma an affluent of the Si, taking its course to the south, where it ultimately joins the waters of the Caspian Sea. At the base of the Bolchoi-Taganai (called Otkliknoi) occur outcrops of diabases. The words of M. Tschernischew are herewith repeated. "*The detailed study of our section demonstrates that all the Taganais show the same succession of rocks rent by a series of faults. It is equally beyond doubt that the quartzites of the Taganais correspond completely with the quartzites and sandstones of the lower Devonic that we have already encountered on our trip to the mines of Bakal and environs. It results indubitably that the metamorphic rocks which support the quartzites of the Taganais are the same clastic modified rocks of the lower Devonic developed in the more western parts of the Ourals.*"

A study was made of the but little altered Devonic measures near the works of Koussinsk where there is an outcrop of dolomitic lime-

stone dipping to the southeast and constituting the "mountain" Silitour. In the neighborhood of Koussinsk also are interesting examples of the limestones with the foliated bosses often heretofore referred to. These limestones belong to the middle Devonic (horizons D_2^2 b with *Spirifer Anossofi*, and D_2^2 a with *Pentamerus bashkiricus*).

On July 30–(August 11), the train was run back from Slatooust on the road some 20 kilometers to the "platform" (flag station) Koussinskaja, and the excursionists were taken in droschkes twelve wersts south to an exploitation of a mine called Schichimskaja Gora. This was simply a cut in the face of the hill of 100 feet or more in width, exposing talc and chlorite slate cut by porphyritic diorite. Many minerals occur at this contact, which may be found described in L. G. IV, 3 +. Returning to the platform, we started after breakfast to the town and smelting works 14 wersts north of Koussinsk, where the pretty iron ornaments sold in Slatooust are made. The start was up a long ascent of the mountain Lipowaia. At a considerable hill called Silitour, just outside of the town, our examination was made of a contact between diabase and the lowest member of the middle Devonic limestone, where M. Tschernischew maintains there is alteration at only one of the two contact planes.

The ascent of the water-divide of the Oural, was accomplished in the train by crossing the Tessma and turning south, where a series

[redacted]

Oufa may be resumed in the letters employed by the Russian Survey, as Permian (P), Permo-Carbonic (PC), Carbonic (C), Devonic (D), and finally the material which constitutes the divide called M, and thought by the official geologists to be metamorphosed Devonic.

It is supposed that the upper and lower black schists are part of D^1_1 g and that D^1_1 c and D^2_1 are conformable with them. The demonstration turns upon this. Beneath D^1_1 c come the schists and quartzites marked metamorphic. It does not clearly appear how the limestones are superposed on it, but unless M be altered Devonic, this is of minor importance. No one would dream of calling in question the accuracy of the Russian geologists who have proposed this structure, without weeks or months of hard and patient labor in the field. To do so would be to show an unpardonable ignorance of the difficulties of the problem and a poor recognition of the accurate work which these gentlemen have accomplished. But they will not consider it disrespectful if some of their recent guests declare that they are not entirely convinced of the Devonic character of these quartzites and schists which form the Oural divide. Only general considerations extenuating this inability to accept the Russian Survey's determination as final are here in order. In the first place the time was not sufficient to observe the contacts M–D^1_1 c and D^1_1 c–D^1_1 g, and D^1_1 g–D^2_1. The first two of these are nowhere so explicitly stated in the Livret Guide as to establish the impossibility of faults. The absence of fossils where these beds were seen deprives us of much needed light. Then again the absence of such important orographic elements as the entire Siluric, Cambric, and Archean is very hard to accept, especially after the investigations of Murchison. The question is one of the highest interest and importance, and it is hoped that more light may be shed upon it in the near future.

There is another consideration which it must be confessed aids in preventing an immediate and unquestioning acceptance of the Russian structure, although it cannot be dignified by the title of an argument, and can be mentioned as an analogy only and with every reserve. Taken, however, together with the other considerations, it is not entirely destitute of weight:—

If we might for the moment leave out of consideration the horizon of the limestone D^1_1 c, and its determination as Devonic we find petrographically an analogy too strong to be overlooked between the sequence of the formations from the crystalline eruptives and

massives, and the schistose and calcareous quartzites and sandstones in other countries and in the Ourals. Of course if it be necessary to accept the series D^1_1 c as Devonic underlying the quartzite series D^1_1 g, this important quartzite member which is petrographically and schematically such a striking analogue of the Cambric (Potsdam) or Primal quartzite is lost: but even then the group M is not proven to be Devonic or even paleozoic by any evidence which it was possible to present to the participants in such a long and comprehensive excursion. The writer does not mean in any way to deny that evidence exists which establishes the original paleozoic character of the group M, he only wishes to say that none such was seen by those fellow members of the excursion of whom he inquired. Of course long and patient investigation is required to place a critic of the Russian Survey's proposed structure in a position to exercise his office. If, after all, this scheme is to stand, it will add another feature (and, perhaps, that which caused all the rest) in which the Oural chain stands out alone among the mountain chains of the world.

Here then is the greatest of the cruces brought to light by the labors of the Russian geologists, and laid before their guests at the recent Congress. It is one which far transcends in interest and importance the Volgian, Tartarian and Permo-Carbonic questions.

The difference in importance between the problem of such a [redacted]

from the west there is nowhere the bold, rugged landscape that one sees in the Caucasus or in Switzerland. It is only by looking back on the steep basset edges of the formations that one realizes the mountainous character of the region. But starting from Ourjum to cross the Eur-Asian line, and descending from that line into Siberia towards Miass the mountainous character is lost altogether. As M. Karpinsky justly says (L. G., V. 2): "On the east slope and at a short distance from the axis the region loses almost at once its mountainous character so completely that, though its geological structure corresponds with a very complex mountain region, the greater part of it presents an area so flat that the relief is less accidented than that of most of the plains of European Russia."

It is like entering the basement of a house built on the steep side of a hill and climbing to the roof to find that a broad plain stretches itself out from that level. This is the first feature to strike the observer. The second is a corollary of the first, namely the infrequency of exposures. The third is the enormous development of lakes. At least one-third of the surface of these steppes is covered by water which is supplied from countless bogs and morasses lying in all positions on the east side of the chain from close up to the axis to a distance further than the eye could see.[4] It has been mentioned that the water courses of the western half in their inception follow the longitudinal valleys parallel with the axis of the chain for considerable distances and with considerable rapidity before breaking through the transverse gorges of about 10 wersts or kilometers more or less in length to the main water arteries on the trans-Volgian steppes. The reverse is the case with the Siberian streams. With a very few exceptions their early course is directly away from the axis of the chain, and the flow is parallel to circles of latitude for a very considerable distance. Over this part they flow sluggishly from and through impassable swamps, showing few or no outcrops on their banks. The outcrops occur on the comparatively elevated country between the water courses.

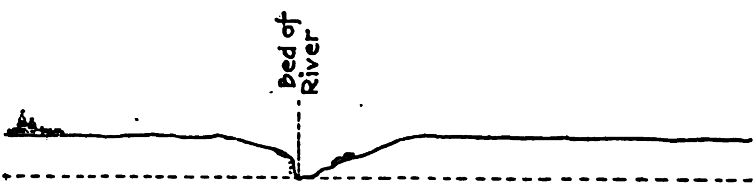
On the other hand, in their middle course (which the excursionists could not observe) the outcrops of rock in place are reported as commencing to appear in isolated places, becoming more and more frequent, and finally uniting in a continuous outcrop. The river is

[4] The characteristic features of the water courses to the east are taken from the Livret Guide, as the course followed by the excursion did not permit the participants to actually see the second and third divisions here referred to.

shut in a narrow bed with rocky banks that often assume the aspect of a veritable gorge of 40 m. (131 ft.) and more in height.

The country, which appears ordinarily flat, falls away only in the neighborhood of the rivers, where it is broken abruptly into rocky escarpments. The courses of the streams thus display scenery entirely different from the surrounding country. Their lower courses are said to be distinguished by large, flat, marshy valleys bounded

Upper Course



Middle Course

[redacted]

The following is a free rendering of M. Karpinsky's general description (L. G. V.): In the most important rivers of the east slope of the Oural, such as the Toura, Taguil, Nitza, Irbit, Pychma, Isset, Sinara, Tetch, Miass, Ouwelka, Oui and Togonzak, the lower course is the most extended. Their western limit coincides almost with the western limit of the region occupied by the tertiary deposits. (See the geological map of the eastern slope of the Oural.) The middle course of these rivers is generally the shortest. The rivers of the Asiatic system of the Ourals are also less abundant in water than those of the European system. The vast lake system of western Asia along the Ourals extends from the very mountain region itself down to the axis of the divide (as in the case of Lake Itkoul, etc.).

In proportion to the distance from the Oural chain the character of the lakes changes more and more, and several types united by those of intermediate character can be recognized. Between the ramifications of the Ourals and near the boundary between the mountain and plain of the east slope, lakes which form on their borders islands and rocky promontories in greater or less number are found scattered far apart in a region constituted essentially by crystalline rocks. Their contours, predominant directions, and distribution, depend habitually on the direction of the schistose crystalline rocks forming the region. In this same direction strings of lakes are found ordinarily enclosed in a belt formed by the same rocks (see on map lakes Silatch, Soungoul, Kéréty, Kasli, Irtiach and Bolchaia-Nanoga, Miassowo, Terenkoul, little and great Kissiagath, Yélowoie and Tschébarkoul). All these lakes have considerable depth even near their shores. Most of them have visible outflows, and their water is always fresh. The lakes of the steppe remote from the Ourals have an entirely different character. Their number is very great, as is the space over which they are distributed, which extends far to the east.

These latter lakes are found in a region occupied by horizontally stratified tertiary deposits. Their forms are simple, and in spite of their large dimensions they are ordinarily shallow. Near their margins one often sees terraces of rounded forms, a proof that at one time they occupied larger spaces. Regularity is observable neither in the directions of their greatest elongation nor in their grouping. Almost all of these are without efflux. Many of them contain fresh water, though in others the water is saline, and in a part of them salts have been deposited. The salt is predominantly NaCl with

$MgSO_4$ and $MgCl_2$. Almost all of these show evidences of gradual drying up. It is worthy of notice that the salinity of the lakes is subject to changes of weather and of the seasons.

The eastern limit of the crystalline region characterized by lakes of type I is separated from the western boundary of the region of tertiary deposits with the lakes of the steppe by a belt composed partly of sedimentary and partly of massives and clastics (tuffs). The lakes of this belt are characterized by certain characters of each of the foregoing types, *i. e.*, the simple form, and straight and low beaches of the steppe lakes and the rocky islets, and correspondence of the lines of their greatest extension with the strikes of the enclosing rocks which are peculiar to the mountain lakes.

The marshes deserve notice. Some are the beds of old lakes now covered with vegetation. Sometimes the small lakes are covered with a mantle of swampy interlacing vegetation. Others are situated on the belt which divides the rivers, and frequently on the quite steep slopes of the hills, independently of the marshes in evident connection with the lakes.

Finally there are regions of salt deposits which characterize the east slope of the Oural. The thin sheets of salt which appear from time to time covering even the plants indigenous to saline terraces with a layer of salt, are developed in the saline lake region, but some small deposits are found in the western region and quite high up on the slope. The variation in the distribution of the saline lakes depends not only on the water infiltrated through the soil, but also [redacted]

procuboides, Orthis striatula, Pentamerus galeatus and the trilobites near the village of Pokrovskoie in the district of Irbit *Phacops fecundus, Anarcestes lateseplatus, Pleurotomaria subcarinata, Tentaculites acuarius*. To the upper Devonic may be classed the limestones of Lake Koltouban, *Monticocerus intumescens, Spirifer disjunctus, Sp. Archiaci*, etc. The Carbonic system is composed of (1) schistose clays and argillaceous schists, sandstones and conglomerates, with intercalations of coal and concretions of Spherosiderite. The organic remains are almost exclusively plants (*Lepidodendron glincanum, Stigmaria ficoides*). At times the rocks are much metamorphosed, and the carbonic schists are transformed into graphites with vestiges of plants. (2) Limestone with *Productus giganteus Pr. striatus*, corals, etc. (3) Limestone of the upper horizons, those of Chartymka, the fauna described by Verneuil. *Gastrioceras marianum, Pronorites cyclolobus* var. *uralensis*. One hundred species of fossils have been found, of which many have not yet been described. (4) Ordinarily the limestone of *Pr. gigant.* are replaced above by a schistose limestone, or by a coarse conglomerate, in which the fragments of limestone of different sizes are held together by a calcareous cement. The conglomerates are replaced by sandstones covered by marls or argillaceous limestones finely stratified with subordinate beds of limestones sometimes coralliferous (*Chætetes radians*) *Syringopora parallela, Spirifer mosquensis*. Above this is a clay with Gypsum.

On the east slope of the Ourals are found islets of mesozoic deposits: clays and sandstones containing lignite. In general the fossils are badly preserved remains of plants. (*Asplenium whitbiense* var. *tenuis, Phyllotheca striata, Prodozamites lanceolatus* etc. and remains of *Estheria minuta* var. *karpinskyana*.)

Finally on the east slope of the northern Ourals occurs the upper Jurassic, containing Ammonites; deposits of lower and upper Cretacic with *Baculites* beds of upper Cretacic with *Belemnitella mucronata, Gryphea vesicularis*, etc.

The tertiary sediments are very remarkable. Commencing at 50 to 100 kilometers from the axis they extend in horizontal beds which grow continually thicker into the interior of Siberia. The predominant rocks of these sediments in the zone nearest to the Oural are sandstones, presenting sometimes very peculiar characteristics, and particularly, a rock composed of an intimate mixture of amorphous clay with an equally amorphous silica. This material covers a very

large area. It appears as a compact rock of light or gray color, sometimes yellowish, of which the typical varieties have the property of disintegrating into minute particles with angular points and curiously curved surfaces. Fossils are extremely rare in these beds. Alongside of the teeth of squali, spiculæ of sponges and of radiolaria, are found the shells of *Lingula*, prints of shells of *Lima nucata*, and the sponge *Botroclonium spasski*. Various considerations have induced the Russian geologists to ascribe these beds to the Eocene.

To the east of these silico-argillaceous beds are widely distributed sandstones slightly coherent, accompanied by sands and clays. In these deposits are found well-preserved remains of fishes: *Lamna elegans*, *L. cuspidata*, *L. denticulata*, *Otodus macrotus*, *Notidanus serratissimus*, *Galeocerdo minor*, *Actobatis*, *Myliobates* etc. Besides this the remains of mollusks have been found; the species most widely distributed—*Cyprina*—resembles very much *C. perovalis*. In addition occur *Modiola*, *Psammobia* (?), *Fusus* (*Neptunea*) *gracilis*, *F. multisulcatus* and *Nautica* sp. The above are classed as Oligocene.

Among the most remarkable deposits of post-tertiary age of the east slope of the Oural besides the glacial deposits developed north of the 61st parallel are the auriferous and platiniferous sands (the latter belonging exclusively to the Ourals). Intimately connected with the serpentines and their primitive rocks, to the disintegration of which the platiniferous groups owe their origin, they are not so [redacted]

"plotik," but rarely on a barren alluvial bed under which is found a second auriferous bed which reposes directly on the "plotik."

The auriferous placers are found in the valleys of rivers and brooks, or in dry ravines, and, of course, follow the axis of their depressions. A gold nugget weighing 36 kilogr. (lbs. 79.2) was taken from the Tzaréwo-Alexandrowsky in the Miass district. Often a slender thread in the placer is found to be richest in gold, and probably indicates the strongest current. The gold of the explored placers varies between 0·57 gram to 2·69 grams per tonne. A larger yield is rare and when found is in the small placers, or in small parts of large placers where it sometimes reaches 16 kilos. per tonne. It is usually accompanied by Magnetite, which is obtained in the washings as sand called "Schlich." More rarely this sand is composed of Hematite, Ilmenite and Chromite. Frequently Quartz and often Platinum, Garnet, sometimes Zircon, Disthene and Diamonds are obtained. The richness of the Oural placers does not seem to depend on that of the neighboring rocks. The most important placers are in regions of greenstones, crystalline, talcose and chloritic schists, etc. The regions of granite, gneiss and mica schist are less productive. The placers on limestones are often found to be peculiarly rich. In this case the rock is cut out in the form of natural buckets, in which the gold is deposited. The Oural placers are post-tertiary, or recent deposits, containing objects fashioned by man, and occasionally post-pliocene deposits containing the remains of mammoths, rhinoceros, etc. Almost all are on the east, very few on the west slope, of the Oural divide. Among the crystalline stratified rocks here are gneiss with Biotite, Muscovite, with two micas, amphibolic, uralitic, etc.; micaceous, talcose, chloritic, siliceous amphibolic schists; various phyllites and quartzites. Among the crystalline schists, limestones and dolomites (marbles) are found sometimes with organic remains. Among the massives, granites, various syenites, miaskite (Nepheline syenite with Biotite), quartz porphyries, felsite, ortho-porphyries, diorite, gabbro, norite, diabase, various porphyrites, various peridotites, diallages and pyroxenites, serpentine and a mixture of Corundum and Anorthite. Many of these have been subjected to more or less dynamic metamorphism, to which among other things the green and uralitic schists owe their existence. The mutual relations of the various formations here are confused from the dislocation of all the deposits (with *the exception of those of the tertiary, post-tertiary and upper cretaceous*, which latter is rarely

met with) and the cutting of all the sedimentary rocks by the massives. The rocks above mentioned occur sometimes in their natural order, but often without any regularity whatever. The beds generally do not dip with the slope but to the west. In proportion to the distance from the axis of the chain the stratification becomes less deranged and the metamorphism feebler, *nevertheless on the eastern slope up to the appearance of the tertiary deposits in force the* different formations alternate without any order. The conclusion of M. Karpinsky is that the principal abrasion of the region has been due to the invasion of the tertiary sea (paleogene), and a considerable part of these deposits have been formed at the expense of the older rocks then rising above the present level of the country. The difference in the geological structure in the two sides of the Oural is reflected in their mineral wealth. Thus the stratified deposits, such as limonite, cupriferous sand and coal, are found principally on the west side of the chain, while the vein or massive deposits are found on the east: the placers are the only stratified deposits of minerals peculiar to the east side.

After the above, which is the resumé by M. Karpinsky of the structure of the east slope of the Oural,[6] it is, perhaps, the best place to consider the interesting question of the cause of this structure which the travellers over the route of the excursion have verified as accurately stated. Several points have been emphasized above to call attention to the part which they bear to the hypothesis advanced

[redacted]

"Prof. Karpinsky states that every one of these streams is divisible into three courses—a fresh-water-lake-region upper course, a gorge-region middle course, and a meander-flood-plain-region lower course.

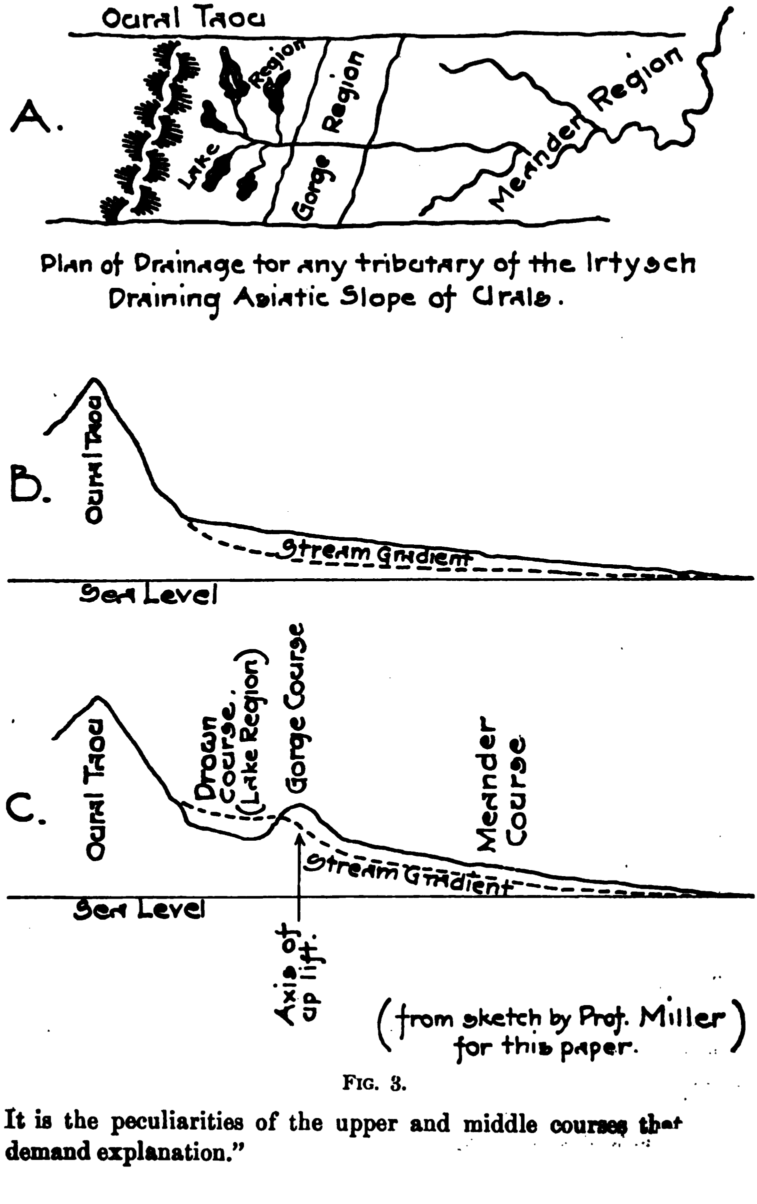


FIG. 3.

It is the peculiarities of the upper and middle courses that demand explanation."

"The presence of lakes nearly always point to recent disturbances in the drainage."

Recognized causes of lakes are:—

1. Glacial action.
2. Volcanic action—crater hollows and lava dams.
3. Chemical solution—producing inequalities.
4. Epeirogenic movements—phenomena associated with draining of newly established marine plains.
5. Sluggish stream action in deltas and flood plains.
6. Minor warpings of the earth's crust—causing changes of gradient in streams.

Of course we readily rule out causes 1 and 2 here. There is no evidence of recent glacial or volcanic action in this region under discussion.

Cause No. 3 would find some advocates as applicable here; but evidence in favor of lakes being formed in this way is meagre.

Cause No. 4 could have hardly operated here, though it may have had influence in the case of the salt lakes of the Siberian steppe region farther to the eastward.

"No. 5 must also be ruled out; we are not dealing with lower stream course phenomena."

"We seem limited to Cause No. 6. Fig. B represents supposed section of district "A" just prior to the development of the lakes and [redacted]

was before. The combined effect of these two movements would be to drown the upper course of these streams and favor the formation of lakes."

The hypothesis first referred to, for which I find that I am responsible, is built upon the admitted structure of the river beds in their divisions described above, and is in effect that at some time posterior to the deposition of the rocks of the middle course, a profound dislocation occurred along the Ourals involving an upthrow of the entire eastern half along a line of fault parallel to and not far from the axis of the chain, which brought the underlying Archean rocks to the level of the Devonic of the western slope. The entire series of rocks forming the eastern slope as far as the present westernmost occurrence of the rocky gorges of the middle slopes were affected by this movement. The high angle and great precipitation cut channels for the rapid streams directly eastward, and ploughed out the cañons in the Tertiary rocks of the Siberian plains. A period of erosion ensued during which the elevated eastern half of the Oural was greatly reduced in height. Following this was a down-throw of less extent than the original elevation but of sufficient extent to reduce the rapidity of flow of the rivers near their sources and on their upper courses, and to transform these latter more or less into morasses and swamps. In time the sunken river beds of the upper courses werefilled by sediments, while the rocky gorges of the middle courses remained as before the channels of streams no longer possessing sufficient rapidity to have cut them. It seems reasonable to suppose that if there had been such movements, they might have produced all the dissimilarity now observable between the two slopes of the Oural, even if the structure of the two sides had been originally similar. The rivers of the east slope prior to the first movement probably originated in the longitudinal valleys of the harder crystalline and quartzite rocks of the east side. Their first courses very likely were rapid and tumultuous and more or less parallel to the axis of the chain, as is now the case with those of the west side, for considerable distances or until favorable places were found for them to break through in lines perpendicular to the axis of the range, when like those of the western slope they may have excavated their beds, first through the older paleozoic rocks and further east through the Tertiary, and finally have reached the level steppes far to the east. The first effect of the elevation would be naturally to produce dis-

trending channels and to cut them so deeply that they would still remain the water courses after the subsequent depression. The final sinking of the eastern half of the chain, would convert the river channels already cut out of the crystalline rocks into deep lakes lying as it is shown these do, more or less in the same direction and within a belt of moderate width. The currents of the upper courses must have become sluggish and the sources of supply have changed to morasses and swamps. The gentle slope directly to the east would be the natural direction of these streams, instead of as originally before the first elevation of the longitudinal valleys, to the N. and S. Wherever depressions of the level occurred, would be found a lake of greater or less extent and these lakes would increase in number and simplicity of form as the angle of descent became less and the rocks softer. The promontories and deep slopes of the old river-bed lakes which represented the parts of more than usually hard rock where the mountain streams had been deflected, and the deep cañons where the maximum erosion had been accomplished, would be less and less frequently seen, the further one followed the river courses to the east. The production of lakes with and without efflux in the level region would follow as a matter of course as is seen in the courses of the Mississippi, the Volga and other large streams.

The existence of the third or intermediate type of lake of which M. Karpinsky speaks, lying between those close to the Oural axis [redacted]

On July 31 (August 12), 1897, we left Slatooust for Orjum, where a halt was made, and a few hundred yards beyond which the continental divide forming the Eur-Asian frontier was reached and passed, and the moderate descent on the Siberian side to Miass at the foot of the Ilmen mountains begun. On the road thither, and at the station Syrostan, a cutting exposes phyllites, a porous talcose rock (listvénite) and serpentine. Further on schistose rocks including metamorphosed porphyrites occur. The other secondary elements are Chlorite, Quartz, Calcite and Epidote. After these, alluvium covers the surface to the station of Miass. Almost the entire region between Syrostan and the Ilmen mountains is auriferous, the central part of the auriferous belt containing the site of the town of Miass. The gneiss on which the town of Miass is built traversed within town limits by peridotite, in its western part is replaced by siliceous schist (kieselschiefer) and phyllite. The Miass placer situated only two kilometers from the station is typical of the eastern Oural deposits of this character. The bed above the auriferous gravel is about 2 to 4 m. thick, and consists of turf, sand and clay. The auriferous bed itself consists of argillaceous sand with many pebbles, and of gravel containing fragments of gneiss, quartz and siliceous schist, of 0·7 m. in thickness. The gold varies from 0·6 to 0·8 gram per tonne. This bed lies on gravel, sand and clay, 2 m. thick. Borings show talcose and argillaceous schists and serpentine below it. A little gold is found above these rocks, but not in paying quantity. The placer which lies in the ground immediately adjacent to the Miass river is about 1,380 m. long by 320 broad. The terrace is the ancient bed of the river. The gold is sought in the lowest points of the ancient and present valleys. The peat or turf which lies upon this gravel is that which extends over so large a part of the Siberian steppes and in which at other places the remains of the mammoth and rhinoceros have been found. The river is about 500 meters east of the present workings. This placer was stated to be but 60 m. above sea level, and the mouth of the Miass but 40 m. (?).

The gravel is screened in a primitive circular rotating screen, of which the axis is inclined, and is then passed over a table having two amalgamated plates at the top and two at the bottom. The shoot is about 5 feet wide and 35 feet long, with a fall of about 20°. The coarse slimes are carried to the top of a scaffolding, while the fine slimes are left.

The Ilmen mountains which lie close to the town of Miass are celebrated as the depository of many, both intrinsically and scientifically valuable minerals, some of which are peculiar to the range. Thus, Miaskite (nephelinic or elœolitic syenite with Biotite), named by Gustav Rose, is not peculiar to these mountains only, which bear the name of Ilmen, but also to their prolongations and the mountains Baiksky, Sobatchia, Potanina and Wichniowaia. In this continuation another characteristic rock is found composed of Anorthite and Corundum. In the gneiss of the Ilmens and their northerly prolongations veins of a rock composed essentially of corundum and orthose are found. M. Karpinsky considers this an analogue of the syenites, the corundum taking the place of the biotite.

The Ilmens are thus more uniform and characteristic throughout the 150 kilom. of their length than the main chain of the Oural itself. "Miascite" (or Miasskite, or better Miassite or Biotite-nepheline Syenite) is found in many places in the Ilmens, of which the chief is near Lake Ilmen. There and in most of the other localities are developed the granular and gneissic varieties of Miassite, cut by veins of very coarse-grained Miassite. A foot note in L. G. V., 22, gives the following as yet unpublished analysis of Miassite by M. Bourdakow:

specifically described by Arzruni in L. G. IV) lie either in miassite, syenite or gneiss. The veins most extensive and remarkable for the minerals they contain are in a peculiar green granite traversing the gneiss. The granite typical of the veins consists of amazon stone (microcline), albite, gray colorless or almost black quartz and biotite. The miassite is often very coarsely granular, the individual crystals attaining frequently 10 centimeters and more, and a specimen of biotite weighing 62·67 kilog. having been found. Some fine graphic granite is formed of quartz and amazonite.

The rock contains cavities filled with argillaceous matter called "salo" (grease) in which are found attached to the walls finely developed crystals of Topaz and among other minerals, Beryl (Aqua marine), Phenacite, Tourmaline, Columbite, Samarskite, Monacite, Monazitoid, Helvine, Garnet, Malaconite, Cryolite, Chiolite, etc.

The veins of micaceous syenite, consisting of Orthose, Plagioclase, Biotite and sometimes Muscovite, which cut the gneiss, contain very various minerals: Zircon, Pyrochlore, Æschynite, Monacite, and sometimes Apatite, Sphene, Magnetite and Ilmenite.

On August 1 (13) the portions of the Ilmen mountains near the station were examined by the excursionists. The distance to the first opening was about 4 wersts, exhibiting miassite containing Zircon, Elæolite and Nepheline.

Besides typical miassite we obtained Elæolite with white masses of Nepheline, Biotite and Ilmenite. The Ilmens themselves are the most gently sloping of hills and of very moderate height. Further on were found openings where Sodalite and Amazon-stone were procured. Among the more important minerals, of which more detailed description will be found in L. C. IV by Arzruni, are Æschynite, Amphibole, Apatite, Beryl, Cancrinite, Chiolite, Columbite, Desmine, Elæolite, Epidote, the Feldspar group, Microcline, Fluorite, Garnet, Graphite, Helvine, Ilmenite, Corundum, Cryolite, Magnetite, Martite, Mobybdenite, Monacite, Orthite, Phenacite, Pyrochlore, Quartz, Rutile, Samarskite, Scapolite, Sodalite, Titanite, Topaz (which was the first mineral found here in the XVIII Century by the Cossack Protow), Tschewkenite, Tourmaline, Uralite and Zircon.

After an examination of these localities the route was continued toward Tchéliabinsk. At the station Bichkil a party of ten excursionists set out in droschkes sixty wersts to visit the gold deposits of Katch-Kar (or Kotch-Kar). This region is situated 80 kilometers southwest of Miass. The 360 to 400 mining localities that the dis-

trict contains are found in the upper course of the rivers Kotchkara, Tschornaia, Osseika, Kamenka and Sanarka. The exploitation of gold began in 1844, when the placers in the southern part of the region Kamenka and Sanarka were discovered. Later these placers became famous on account of the precious minerals, Cyanite, Beryl, Rose Topaz, Amethyst, Euclase, Ruby, Corundum etc., which occur with the gold. The first gold in primitive rock in place was discovered in 1863.[6]

The auriferous region lies in the middle of a large granite zone running north and south. The gneisso-granites strike approximately east and west, but have been broken through in a direction perpendicular to this, as is shown in numerous more or less parallel cracks and faults. The faults have in their turn caused the enclosure as veins of masses of granite transformed by dynamo-metamorphic action to a dark greenish gray rock generally schistose, and composed of very finely crushed masses of Orthose, Plagioclase, Quartz and Mica, with secondary elements, Biotite, Amphibole (in certain veins), Chlorite, Talc, Calcite, Pyrite, etc. The country rocks are a granite called bérézite with Feldspar partially or entirely transformed to Quartz and Muscovite. The thickness of the exploited veins varies between 0·05 m. and 2 m. The veins consist of gray or green opaque Quartz, in which are inclusions of little veins of Chalcedony in very variable quantities (here and there of Calcite and Chlorite), but filling the whole crack. The Chalcedony is repre-

[redacted]

part of the belt of sufficiently disintegrated rock which allows the extraction of ore by the simplest processes (crushing and amalgamation) has alone been exploited. To separate the chalcedonies the "stossherd" and Frue vanner are used. The most important operations are those of the Mitrofanovsky shaft (40 m.), Woskressensky (80 m.), the shafts Gavriilo-Arkhanguelsky (70 m.), Loukochinsky (73½ m.), Woskressensky (56 m.), Pavlovsky (50 m.), Alexandrovsky (63 m.), etc.

In latter years the yield of gold from the primitive rocks, where it occurs as an ore, has been 1300 to 1425 kilogr. per year for the district of Kotchkar, while the placers have given but 300–350 kgr. The total production of gold from 1844 to 1897 in this region is about 47,067 kgr. (103,547.4 lbs.=51.77 tons) of which 25,160 kgr. came from the placers, and 21,900 from the veins (since 1868). To this some 450 kgr. of silver must be added.

Amphibolic and biotitic gneisses crop out over the entire space which stretches to the Lake Tschébarkoul, and beyond veins of the amazonite granite disappear imperceptibly, but the ordinary ouralian granite with Biotite grows more frequent and extensive until it becomes predominant. The gneiss squeezed between masses of granite contains frequent injections of it and innumerable dykes and veins. Beyond Tschébarkoul the outcrops become more rare. At 4½ kilom. from the station siliceous schists appear, interrupted by a serpentine; further on, chloritic, talcose and argillitic schists succeed. These schists are replaced by green-stones, augitic and ouralitic porphyrites and aphanites, transformed here and there by dynamo-metamorphic action into uralitic schists. Here and there along the line of the railway gold is exploited in placers and veins.

On August 2 (14) the party moved along the line of the trans-Siberian railway to Tchéliabinsk, the easternmost point which was reached during our sojourn in Russia, viz., over 30° east longitude from St. Petersburg, or about 61° E. of Greenwich. This very important railway center is a new town built on a number of gold veins which have been exploited in latter years. The mines are mostly from 16 to 20 kilom. southwest of the town, and have a general similarity to those of Kotchkar. One of the best organized mines is St. Michael Arkhanguel, belonging to M. Wonliarliarsky & Co.

Along the line of the railway towards Kytchtym the granite is followed for 8 kilom., and near the crossing of the Miass is cut by ramified veins of quartziferous diorite. The granite underlies red

and yellow post-tertiary clays covered by tschernozem. From the 7th to the 52d werst from Tchéliabinsk the clays cover the oldest rocks almost everywhere. It is only in rare instances that one observes the islets of tertiary conglomerates and sandstones, which have escaped erosion, appearing above the surface (12 to 43 wersts) and siliceous clay with Glauconite (44 wersts), a Kaolin produced by the alteration of a subjacent granite, a diorite (?) (32 wersts), a dioritic porphyrite (Lake Kissiagutch) and a Labradorite porphyry (46 wersts). From the 50th werst such outcrops become more frequent. First come aphanitic and other massive altered and clastic rocks. At the 64th werst an uralitic porphyrite occurs, becoming an uralitic schist; then serpentine and chloritic schist, and finally gneiss and granite alternating with chloritic and uralitic schists, which predominate further on, and upon which are built the Kytchtym works. The gneisses are often biotitic, often amphibolic, and often garnetiferous. The strike of all the crystalline rocks is nearly that of the meridian. (L. G., V, p. 33.)

August 3 (15) the party of excursionists left the station of Kytchtym in droschkes and drove around lakes Kytchtym and Sougomak to the base of the Sougomak mountain. Between Kytchtym and Sougomak mountain only biotitic and amphhibolic gneiss were observed, cut by peridotites more or less serpentinized on the north of the lake. At the same place appear in irregular prominences [redacted]

From Kychtym to Ekathérinebourg the road passes over bands of gneiss cut several times by granite (traversed by veins of syenite). There is a region of chloritic talcose, etc., schists among which is found for instance at the 91stwerst uralitic porphyry transformed to schist. At the 99th werst these schists change the west dip to south for half a werst. Beyond the station Maouk, where the schists have been studied by Morozéwicz, serpentines occur and predominate to the 115th werst.

The chloritic schist contains large crystals of Magnetite, the talcose schist nests of radiating Actinolite of emerald green, and the serpentines a number of veins of Asbestus. The whole is covered by a bed of turf three meters thick. The serpentine contains marble at the 126th werst. Among numerous hills of serpentine one may observe numerous nuclei of gabbro and gabbro-diorite, and other rocks giving origin to serpentine. The summit of the divide between the waters of the Tschoussowaia and those of the system of the river Isset consists of chloritic schist. Marble accompanied sometimes by listvénite has been exploited for years in the vicinity of the village Mramorskoe. Succeeding this for six wersts or more come gneiss and granite, followed by more chloritic and talcose schists, etc., accompanied by serpentines, diallage, pyroxenite, uralitic porphyrite and occasionally by granite and porphyry.

Ekathérinebourg.—Chloritic schists occur within the limits of the city, as well as listvénite, serpentine, diorite or gabbro-diorite, uralitic porphyry, usually changed into green so-called uralitic schist. Here and there these schists contain beds of gneiss.

Besides these (See L. G., VII) in the neighborhood occur limestones and granite.[7]

While a part of the excursionists were examining the so-called stone tents and the archeological remains of Werkh-Issetsky, others visited the mineral localities of Eugénie-Maximilianovna to the

[7] Ekathérinebourg is the seat of a very active and learned society of amateurs of natural history, which has made valuable natural history and archeological collections. A fire destroyed many of the most valuable objects of the former collection, but this has not prevented the growth of the society. Valuable remains of a former tribe have been found on the island in lake Werkh-Issetsk and in the vicinity of the hamlet of Palkino. M. George-Onésime Clerc is the very efficient secretary of this society, a savant amateur, who has for twenty-five years been the chief active spirit within it. He has recently made the discoveries of human relics previously referred to, and desires to be able to compare some of the objects with those of the North Am Indian.

northwest of that village, to the right of the river Isseta, and almost on the summit of the Oural divide. Besides minerals about which the data are not yet complete, such as Disthene, Beryl of lilac color, red Corundum, etc., there are met with here Aqua marine, Vesuvianite, Garnet, Essonite and Almandine, Epidote in great abundance, Pouschkinite, Axinite, Yttrotantalite, Titanite, Chinochlore, Amazon stone (Microcline) in great crystals, Amphibole, Rock Crystal Pyrite transformed to Limonite, etc. These occurrences are in a development of gneisso-granites. The predominant rock is a feldspathic rock, poor in mica and almost destitute of Amphibole. This feldspathic rock is accompanied by a rock very rich in Amphibole, sometimes closely associated with amphibolite (Mt. Medwejka, Romanorka), sometimes with amphibolic gneiss (Medwejka, Poup), sometimes with a diorite (Séwernaia, Yélowaia), which occupy lower horizons than the feldspathic rock, although they constitute independent and not very great elevations.

The above minerals are the product of metamorphism. They are found usually at a slight depth in contact with feldspathic and amphibolic rocks, and are almost always accompanied by Epidote. In the mountain Poup the minerals accompany the crystals of dolomite, and are found in places where the dolomite comes in contact with amphibolic gneiss, the surface of the hill being formed of granite. The deposits of the greatest interest are:

Mount Medwejka—Yellow Essonite, rose colored and brown Pis-

[redacted]

The minerals offered for sale comprise all those which are known in the entire Oural region as well as those from this particular district, and have no further claim to enumeration here, since they will be mentioned in connection with the visit to the localities where they occur. This and the other great lapidary institution of Russia at Peterhof employ some of the most skilful artisans in the world.

Leaving Ekathérinebourg on August 6 (18), the railroad passes successively over the narrow belt of diabases, etc., bordering the city on the west, and runs northwest nearly parallel to the upper shore of the lake Werkh-Issetsk through narrow tongues of diallage and limestones, and of crystalline schists called M, into the broad belt of granites and syenites containing lakes Isset, Tawatoui, and others. Skirting the southwest and west shores of these at some distance at about the middle of the last named the road swerves to a direction east of north, and follows a thin band of the crystalline schists, M, to its extremity, then passing along the contact of limestones and diabases, and subsequently through first one and then the other of these rocks across a very complicated area. A long course is made through gabbros, etc.; to the station Anatolskaja, near which is the boundary of the mining district of Nijni-Taguil. Between Anatolskaja and the mining center Nijni-Taguil the road lies in granites and syenites, and finally in diabases, porphyrites and tuffs to Taguil and Nijni-Taguil, which are situated at the contact of these rocks with the lower Devonic limestones and marbles.

Nijni-Taguil the most considerable mining locality of the Ourals, is the property of the heirs of P. Démidow, Prince of San Donato. The founder of the works was Nikita Démidow, who enjoyed great favor with Peter the Great, and established a number of iron works in the Ourals. The river Taguil is dammed at this mining center, and makes a long, narrow lake 12 wersts long, at the northern extremities of which are the hills (or mountains) named Lyssaia-gora (Bald mountain) and Wyssokaia (High mountain). This latter, situated at the west of the village, contains the rich deposits of magnetite which furnish the works of Nijni-Taguil, Niéwiansky, Alapaievsky, Werkh-Issetsky, Soukhsounaky and Révdinsky. At Wyssokaia the predominating rocks are porphyries without quartz, and very varied in respect of their constituent elements. The passage from typical porphyritic texture with well-developed crystals of Orthoclase and sometimes of Plagioclase and Augite into augitic syenites or

holocrystalline uralite on the one hand, or into compact orthose on the other is here observed. The intimate correlation of the combined elements of different structure and color appears in the ribbon or spotted structure of the rock, offering a good example of the composition of the "Schlieren."[8] The interpretation of the structure by M. Tschernischew is that the metalliferous masses and the accompanying rocks were formed simultaneously, and that the beds of magnetite have separated themselves from the magma of orthose rocks. The magnetite and accompanying rocks of Wyssokaja dip generally southeast and east, but the structure is complicated by throws and faults to be seen on the west end of the mountain.

Brecciform rocks form the base of the series of metalliferous beds of Wyssokaja. Here can also be seen the disintegrating action of the orthose rocks, which results in the formation of thick beds of white and pink clays, enveloping blocks of magnetite. The iron of Wyssokaja is distinguished for its purity and excellent metallurgical qualities. The magnetite is very often observed passing into martite, a mineral very abundant near Taguil.

Among the minerals of Wyssokaja are Asbolan and Rabdionite, forming in places very thin deposits on the walls of fissures in the Magnetite and Martite. Immediately to the south of these mines occur the outcrops of a white siliceous limestone, which forms the [redacted]

out here have given great celebrity to the mines of Médnoroudiansk. The celebrated block of Malachite weighing 20,000 pouds (lbs. 720,000, or 360 short tons) was found at a depth of 35 or 40 sagenes (245 to 280 ft.) from the surface. In the neighborhood of the limestones the metalliferous rocks become richer in copper salts as the limestones are constantly being dissolved by infiltrating waters. Fossils from these limestones are observed in great number (*Pentamerus vogulicus, Atrypa reticularis, Murchisonia Demidoffi, Pleurotomaria ventricosa, Euomphalus subalatus*). M. Tschernischew concludes that a chemical action takes place at the contact of the limestones and the ore bearing rocks. On the one hand the limestones are dissolved, and from the argillaceous envelope results the insoluble residue. On the other hand the deposits of copper are brought about by the precipitation of this metal, which is carried to the limestone by waters holding it in solution.

The manganese mines of Taguil.—About a werst to the northeast of Lébiajaia is found the manganese mine which is exploited by two trenches. The south wall of the south cut exhibiting bright gray and white limestones dipping southwest 60°, and containing *Atrypa kuchvensis, Spirifer kuchvensis, Sp. pseudo-kuchv., Entomis pelagica*, stems of crinoids and corals. Beneath this is a white dolomite, resting on a marble-like limestone, which is in immediate contact with yellow, pink and violet schists, cropping out in the north wall of the mine. North of the schists appear the same limestones seen in the hanging wall, honey-combed with stems of crinoids and corals. Presumably this represents a tightly folded and inclined synclinal of limestone enclosing the schists. The manganese ore is collected in nests and pockets, and seems to indicate a relation between its occurrence and the lower Devonic limestone.

Ascent of Mount Siniaia.—Leaving Taguil and proceeding north through Laia and to Barantcha the road runs on porphyrites and tuffs. From the crossing of the Taguil to the latter place the road crosses gabbros and diallage rocks. The best exposures of the rocks composing Siniaia are seen in the quarries, which show a diallage alternating with gabbros. Here may be seen excellent instances of Schlieren. The structure is not to be explained by gabbros cutting the diallage rock, for, on breaking it in various directions, even under the microscope, it is impossible to define the limits of the two rocks.

The summit of the Siniaia mountain known as "Koudriawy-Kamen" is almost entirely formed of coarse grained diallage rock containing a considerable quantity of olivine. From the summit of Siniaia or Koudriawy-Kamen (crumpled stone) a splendid view is obtained of the summits of the ranges. To the north appears Mt. Katchkanar, and Mt. Blagodat, to the southeast is the village of Laia and the works of Taguil, to the west is the Oural chain, here running nearly north and south.

Kouchwa and Mount Blagodat.—After a short run of nine wersts north and northeast through gabbros, gneiss, and diabase, we reach the station Kouchwa, on the last named formation, where the crown owns works. The station is at the junction of the great and little Kouchwa. The western part of the village extends over the large low plain of these streams. Two wersts from the town is situated Mount Blagodat. The constituent rock of this mountain, like that of Wyssokaia, is an orthophyre without quartz, but with crystals of Orthose and sometimes Plagioclase or Augite. All transitions from coarse grained uralitic and augitic syenites to perfectly compact orthose rocks *resembling in external aspect the Swedish* "*Hällaflinta*" as observed by G. Rose. The rocks also approach the structure of "Schlieren." The microstructure, the predominance of Feldspar in the matrix and among the porphyritic elements, and finally the notable content of sodium bring the greater part of the rocks of Blagodat [redacted]

On the east side the rocks are separated into strata and dip to the east and southeast. Near the summit the rock is in the form of an anticlinal and the direction of its axis about corresponds with the trend of the mountain.

The deposit is faulted in lines nearly perpendicular and approximating north-northwest and east. As a result of the first faulting, part of the wall of the deposit is thrown to the west flank of the mountain, and owing to the second, the main deposit is cut off to the south on the eastern slope. The folds and faults corresponding with the first of these are anterior to those corresponding to the second or transverse, which accounts for the folding back of the rocks of Epidote and Garnets and their appearance on the west flank to the foot of the eastern slope in many places as a result of the first movement. (See L. G., IX, Pl. F.).

The mineral deposits have experienced the same fractures as the rocks containing them, as is evident from the strips of Magnetite included in the breccias which fill the cracks, and the slickensides of magnetite. The narrow bands of limestone compressed within the porphyritic rocks to the east and south of Blagodat contain a fairly rich fauna often well preserved. The limestones of the lower Devonic (hercynian) along the rivers Kazanka and Izwestka for a distance of 4 wersts southeast of Blagodat abound in fossils, among which M. Tschernischew has described *Calymene, Entomis pelagica, Pleurotomaria kuschwensis, Merista passer, Spirifer pentameriformis, Sp. kuschw., Sp. pseudo-kuschw., Atrypa kuschw., Pentamerus parvulus, Pent. integer, Orthis pseudo-tenuissima.*

The occurrences of these ores of Wyssokaia and Blagodat, and the relation they seem to bear to the orthophyres on the one hand and to the eruptive diabases and porphyrites on the other, will naturally suggest to the mind of the student of Pennsylvania geology the Cornwall and Dillsburg deposits. The quotation by M. Tschernischew of G. Rose's comparison of one of the transition forms of these rocks to the Swedish Hällaflinta only increases the the analogy to the series in Pennsylvania and other parts of the United States, as well as in Wales, to which the late Dr. T. Sterry Hunt so often referred. There are many other analogies, as in the presence of copper and manganese in the Wyssokaja, and the irregular pocket and mass occurrence of the ore in Blagodat. The resemblances in the two countries in these respects is very striking, and is not marred by the Devonic limestones at various

points south and east of Blagodat. It would seem that the complete history of these very interesting mineral deposits remains to be told, and that there is some reason to believe that it will be found to be similar in Pennsylvania, Cærnarvonshire, and the district of Goro-Blagodat.

Recrossing the Eur-Asian frontier.—Leaving Kouchwa the railway continues for a short time in a northerly direction, when it turns northwest before reaching the river Toura. Up to this point it is laid almost exclusively on porphyries accompanied by tuffs and breccias.

The porphyrite breccias consist of a paste of plagioclase and augite, showing plain fluid structure in which occur Labradorite and Augite (partly Uralite). Fragments of different sizes of dark gray ribbon schist, of porphyrite and of quartz, are held in the paste. Occasionally a large fragment of schist a meter in length enclosed in the porphyrite indicates the vicinity of a continuous mass of schists. Up to the present only one outcrop is known, viz.: to the left of the Toura, between the great and little Garevka. About two wersts from the Eur-Asian crossing a region of much metamorphosed gabbros is entered. These gabbros are remarked also west of the station. Then (197 wersts from Ekathérinebourg) commences a region of indubitably metamorphic Chlorite and micaceous schists which constitute the central part of the crest of the Ourals. Beyond the boundary station the railway crosses the Toura for the last time [redacted]

dipping east 75°, bring us to the 242d werst, where black dolomites of fine grain intercalated with thin veins of calcite dip along with the quartzites. Further on black argillaceous schists and chlorite and argilo-chloritic schists appear. At the 230th werst the gabbros of Douplianoi-kamen, a southern continuation of Teplogorskaja-sopka, are met. From the 215th werst, at the maximum elevation of 469.7 m., the road pursues the crest of the water divide between the affluents of the Wejai and the affluents of the Koiwa, and descends rapidly for 43 wersts to the station Pachya. In the cuts between the 189th and 185th wersts black argillaceous schists occur. Beyond the station Biélaia, in a cut on the 184th werst, a light gray arkose coarse-grained sandstone appears, and further on argillaceous schists alternating with finely stratified sandstone. At the 177th werst light gray, compact and dark gray crystalline limestones of middle Devonic appear with *Cyathophyllum*. From this point to the station Pachya the upper Devonic limestones appear with *Cyrthia murchisonia*, *Atrypa reticularis*, *Orthis striatula*, etc. Beyond Pachya the road enters the Carbonic deposits, which it follows to Vsiéswiatskaïa. A cut at the 166th werst shows compact gray fine grained limestones C_1^2 b with *Spirifer mosquensis*, *Productus cora*, *Pr. semireticulatus*, *Pr. Humboldtii*, *Chonetes variolaris*, *Fusulinella sphæroidea*, etc. From here to Vsiéswiatskaïa only a few outcrops are seen of white quartzose, fine grained sandstone and clays. The occurrence of Carbonic measures continues. At the 122d werst C_1^2 b again is seen with *Spirifer mosquensis*, *Pr. cora*, *Pr. semiret.* Near to the junction of the Arkhipovka and the Tschoussowaia C_2 crops out with *Fusulina verneuili*, *Pr. cora*, *Spirifer stri.*, *Streptorhynchus eximiæformis*, etc.

The limestones of the upper Carbonic dipping northeast in the cut of the 121st werst hold a thin bed of calcareous sandstones of greenish gray, with remains of calamites, species of *Productus*, etc., interstratified with a gray conglomerate and an arenaceous schistose clay. The presence of this permo-carbonic sandstone between the upper carbonic limestones dipping to the northeast is explained by a reversed fold to the southwest.

To the north of the station Tchoussowaia the outcrops of the white Gypsum of the permo-carbonic series are seen on a little hill. From the station Tchoussowaia to Perm, a distance of 119 wersts, only Permo-Carbonic, Permian and post-pliocene exposures are found in the infrequent and shallow cuts. Between the stations Liévchino and Motowilikha the road follows the right bank of

the Kama. At the 11th werst a gray, friable, calcareous sandstone P_1^b appears. Between the village Malaia-Yézowaia and Motowilikha is an outcrop of gray friable, partly calciferous sandstone P_1^a horizontally bedded and alternating with marly clays of reddish brown and gray marls. Near Motowilikha the hill is cut by the deep valley of the rivers Motowilikha and Iwa. On the right side of this valley in a hill known as Wychka the greenish or reddish gray calciferous sandstones P_1^b crop out, alternating with clay marls of deep red and thin seams of light gray marl, all covered by sandy clay of yellowish brown, and pebbles. From here to Perm the outcrop is almost continuous of more or less friable calciferous sandstones of greenish or reddish gray color alternating with deep red or gray clay marls, and covered by post-pliocene deposits, more or less yellowish brown sandy clay, yellow or gray argillaceous sand and pebbles. The dip near Perm and Motowilikha is very gentle, but visible S–3°. [L. G., X.]

Perm.—The city is built on the left bank of the great river Kama, which resembles in many superficial features the upper Missouri. The first view of this river at Perm, (which is 650 kilometers over its bed from its source, and about 700 kilometers from its junction with the Volga), is likely to cause astonishment at its breadth and importance; and indeed at the delta near Bogovodskoïe where it joins the mighty Volga, the Kama appeared in August to [redacted]

contains large deposits of copper minerals (principally cupriferous sandstones) which have been exploited until very recently and the ore smelted at the works of Motowilikha. The lower horizon P_1^a of lower Permian can be seen in the mountain named Tschourbina which is on the right bank of the Kama opposite the mouth of the Tschoussowaïa. This horizon of gray calcareous slaty marls interstratified with gypsum and reddish brown sandstones carries the bed P_1^b composed of greenish gray sandstone, interstratified with reddish brown clay. The right bank of the Kama opposite the city of Perm is low and barren, and formed of post pliocene deposits such as gray and brownish gray argillaceous sands with beds of pebbles and recent deposits. A short distance down the stream from Perm these sands lie on the Permian bed P_1^b which contains somewhat cupriferous sandstone.

Throughout the entire distance from Perm to the confluence of the Kama with the Volga, the banks of the former river exhibit exclusively Permian measures. The overlying beds are considered by some of the Russian geologists to be lower Triassic, but others think they are not sufficiently well known to be ascribed either to the upper Permian or the lower Triassic, and designate them Permo-Triassic or PT, and call them provisionally Tartarian.

For two thirds of the distance from Perm to the Volga only the lower Permian beds P_1^b, and Quaternary are seen, unless the deposit at Kerakoulino below Sarapoul be considered Tartarian in accordance with the views of some members of the Russian Geological Survey. M. Stuckenberg, who is the author of L. G., XI, which describes the geology from Perm to Nijni-Novgorod, and was also the leader of this part of the excursion, holds this to be erroneous. According to him the middle Permian (P_2) commences to appear at Tikhia-Gory, and continues to Sentiaki where the upper Permian (or Tartarian) appears and lasts to and beyond Tschistopol. The further localities on the river from here to Laïchew are credited by him only with the middle Permian P_2. For the rest of the Kama's course, these higher beds with Quaternary persist. He states that in the Kama section the lower Permian is represented by but one member, P_1^b, which consists of gray or brownish gray sandstone, interstratified with more or less nearly red or reddish brown clays, often containing calcareous concretions. Very rarely are found remains of conchifers accompanied more frequently by remains of plants. This bed is 70 to 80 inches thick in the sections near Perm,

Ossa, Ochansk, Sarapoul, etc., and disappears finally further down near Elabouga.

The middle stage of the Permian (P_2) is composed of limestones, dolomites and gray clay marls, and contains the organic remains characteristic of the Zechstein of Germany. It crops out in incomplete sections in the banks of the Kama, between its confluence with the Ij and its confluence with the Volga. At Elabouga the bed P_2 is seen lying on the lower stage P_1^b.

The upper stage P_3 or PT is seen between Sarapoul and the nearest confluent of the Kama to the south[1] covering occasionally the middle stage. It consists principally of clays and marls of a variously tinted red, alternating with beds of white, greenish or gray color. Organic remains (conchifers) are very rare.

The post-pliocene deposits which crop out in the banks of the Kama are represented partly by a fluviatile terrace, and partly by sediments deposited in the Caspian basin of this period: or, to be more accurate, in the series of lakes which were in communication with that basin. These deposits crop out between Tchistopol and the mouth of the river, by preference on the left bank. The post-pliocene terrace is composed of yellowish brown clays with which sands are oftentimes associated. The Caspian beds though nearly of the same nature as those of the post-pliocene terrace are more sandy. These beds contain the remains of mollusks still living in the east of Russia. The fresh or brackish water forms are often accom-

[redacted]

penetrating several kilometers into the interior of the country presents Quaternary terraces in gentle echelons. When the confluents of the Volga on the left bank unite with the major stream, their valleys are merged into vast spaces like lacustrine basins which owe their origin to the impeded flow of the melting snows and the strong floods of spring. At the confluence with the Kama the lacustrine enlargement begins in the Volga, twenty-five kilometers above Laichew and extends south to Spassk and the ruins of the old town of Bolgary. In the months of May and June the waters of the Volga and Kama at this junction occupy a basin so extensive that from a steamboat it is occasionally impossible to see the shores. In these cases the level of the water is 12 to 13 meters above the normal level. But in the month of August the two rivers have returned to their original beds and the water level has attained its minimum. It happens frequently at this season that the steamers seeking the sinuous and constantly changing channels run aground. This shallowness is most annoying toward Nijni-Novgorod and above.

The left bank of the Volga between the Kama and Nijni-Novgorod shows no older rocks. Most frequently only recent sediments are seen. In some rare localities are found post-pliocene deposits, clays and sands of the terraces, and between the mouth of the Kama and Kazan Caspian lacustrine deposits.

The right bank throughout the whole distance is of middle and upper Permian and of Tartarian or Permo-Triassic age. The middle Permian stage, the representative of the German Zechstein, is composed of limestones and dolomites, partly of oolitic structure, with interstratified beds of silex, and more or less considerable deposits or accumulations of Gypsum. This stage, which contains almost everywhere many organic remains characteristic of the German Zechstein, rises from beneath the upper stage between Bogorodskoie (the mouth of the Kama) and Kozlovka (opposite the mouth of the river Ilet and 30 kilometers below the town of Sviajsk). The upper stage (P_3) or the Tartarian (PT) consists principally of different colored (red, pink, white, greenish and greenish gray) marls, accompanied by thin beds of white limestone, variously colored clays, and sandstone. This bed is very little fossiliferous, and contains only some conchifers.[10]

[10] Fifteen years ago the opinion was held by certain Russian geologists that the beds of iridescent marls P_3 or PT were parallel formations with a part of the beds P_2., with passage of the marls into these latter horizontally. Now, thanks to the labors of the Geological Survey and to recent researches of the geologists of Kazan, it is beyond doubt that P_2 and PT are independent stages bedded the one in the other. [L. G., IX, p. 10.]

At the landing place of the village Bogorodskoiё, a little above the mouth of the Kama, the following is a section of the right bank.

P_3—Light red and brownish red marl.

P_2—Greenish gray marl.

Gray limestone, finely stratified with brown spots, containing casts of conchifers.

Brown, friable sandstone, with white strata.

Finely stratified gray marl.

Boulders.

The beds, which are hidden by boulders, are shown a short distance below.

P_2—Finely stratified grayish limestone, ...	0·75 m.
Friable sandstone, ...	0·75
Gray marl, ...	0·25
Boulders, ...	2·5

Between the above two outcrops, in a rocky promontory, are shown:

P_2—Finely stratified, gypsiferous limestone, soiling the fingers, ...	0·5 m.
Finely stratified, grayish limestone, with remains of conchifers, ...	2·–
Gray clay marl, interstratified with gypsum, and containing many specimens of *Lingula orientalis*.	0·5

[redacted]

pliocene deposits. The first of these predominate in all the outcrops and are almost always covered by the others. The upper Permian, P_3 or PT, attains a thickness of 100 m. and more. It is developed in an uninterrupted series of marls, sandstones, conglomerates and more rarely limestones.

The predominance in the series of this or that deposit affords a differentiation of the following horizons:

A. Clay and marls with interstratified beds of limestone.

B. Sands and conglomerates with subordinated marls.

C. Marls and sands with subordinated sandstones.

D. Sandstones and sands with subordinated marls.

E. The same rocks with beds of limestones and conglomerates.

In all the sections the horizons B and C are the most definitely and best expressed. The horizon A is in most cases eroded. The lower horizons are most frequently masked by slips and detritus and are not very visible, except near the villages of Issady, Barmina, and Wassilssoursk. The fauna is represented by numerous conchifer mollusks of the group *Anthracosidæ*, especially by the genera *Palæomutela*, *Oligodon* and *Palæoanodonta*; by rare gasteropods *Estheria*, *Palæoniscidæ*, *Ceratodus* and *Stegocephali*. The plant remains are generally badly preserved.

The Jurassic and Volgian deposits cover in separated islets the Permian series of the environs of Issady, Barmina and Wassilssoursk. These are dark gray clays with subordinate beds of sand, conglomerates and limestone. Their ages are referred to the Callovian, Kimmeridgian and Volgian epochs.

The Post-pliocene is represented by yellow lœssoid clays enclosing a few pebbles and crystalline rocks.

Below Issady the Volga valley's right slope forms an enormous curve, in the upper part of which are seen from the steamboat yellow outcrops more frequently of lœssoid clays (Q_{II}), gray outcrops of the Jura (J) partly hidden by thickets, and below, the outcrops of Permian (Tartarian) rocks (P_3 or PT). The Jura, which is of exceptional interest in this section, is unfortunately less visible to-day than a few years ago, when Sibirtzew, in 1886, established the following sequence:

(1) Yellowish brown lœssoid clay.

(2) Dark green sandstone with *Aucella mosquensis* of the Volgian horizon (horizon of *Oxynoticeras catenulatum*).

(3) Black bituminous clay without fossils.

(4) Brownish and yellow clay with a bed of limestone (*Oppelia, Perisphinctes*) determined as a zone of *Hoplites* of the Kimmeridgian.

(5) Sandstone of the lower Callovian and conglomerates with *Cosmoceras Goweri*, *Cadoceras sublæve*, some forms of *Perisphinctes*, accompanied by *Belemnites*, *Protocardium*, *Concinnum*, etc.

(6) Gray clays of the gypsiferous lower Callovian, with prints of *Cadoceras*.

(7) Variously colored marls.

(8) Sands and conglomerates with subordinate marls.

(9) Marls interstratified with limestone.

Issady—Nijni-Novgorod.—Among the outcrops on the old right bank, between the landing places of Issady and Nijni-Novgorod, that below Takinsky deserves especial attention, on account of the appearance of the middle and lower horizons of the marly and sandy Permian rocks, notably the series C_1—marly, D—arenaceous marly, E—marly calcareous.

Nijni-Novgorod.—The city is situated on the high and rather steep right slope of the valley, at the confluence of the Volga with the Oka. On the side of the Volga the slope is partly covered with vegetation, partly with buildings, débris, etc. On the Oka side, on the contrary, fine outcrops permit one to see the structure. Two sections are especially characteristic: the first in the banks of the river Yarilo and the other in the ravine near the camp. The first of these [redacted]

same shells are encountered in other beds of limestones and marls, but very badly preserved and in the form of interior casts.

The lower horizons of the Permian deposits appear more distinctly above and below in the ravine. There is visible 30 or 40 meters below the place just described, between variously colored marls, a bed of sandstone and conglomerate in which are encountered the shells and other remains of ganoids, accompanied by casts of conchifers.

From the plateau the view extends far into the valleys of the Volga and Oka and over the terraces of the left slope of the valley.

From Nijni-Novgorod to Moscow. — The railway from Nijni-Novgorod to Moscow, following up the valley of the Klinzma crosses a band of Permian, and later a long and narrow belt of middle Carbonic limestones, following which it again crosses a narrow band of Permian before reaching the Jura-Cretaceous or Volgian on which it continues all the way to the ancient capital.

The Oural excursion was thus concluded after having passed rapidly over 3,750 kilometers, (2,330 miles) of the most important of the geological horizons in south and east European Russia, including a long and typical part of the Volga, nearly a sixth of the entire length of the Oural Mountains both in Siberia and in Europe, and more than half the length of the river Kama.

The insight which this journey affords to the geological structure of central European and Asiatic Russia could not have been obtained in any other investigation of equal length and time, nor in any other less well prepared, illustrated, and conducted.[11]

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[11] The sincere thanks of all students of geology are due to his Imperial Majesty, the Tsar, for the boundless liberality he extended to the foreign visitors; to the Russian geologists for the enormous and intelligently directed labor they devoted to the preparation of the means for demonstrating their vast and difficult problems to hundreds of strangers ignorant of their customs and language; to their energy and pluck in carrying out their programme without a mishap; and to the hospitality and kindness of all classes of their countrymen, who made the long journey a continuous succession of pleasurable experiences.

NOVEMBER 2.

MR. CHAS. P. PEROT in the Chair.

Twenty-six persons present.

NOVEMBER 9.

The President, SAMUEL G. DIXON, M. D., in the Chair.

Twenty-seven persons present.

Papers under the following titles were presented for publication:—

"New Brazilian Streptaxidæ," by Henry A. Pilsbry.

"Notes on Living and Extinct Species of North American Bovidæ," by Samuel N. Rhoads.

NOVEMBER 16.

The President, SAMUEL G. DIXON, M. D., in the Chair.

Thirty-five persons present.

The death of Harrison Allen, M. D., on the 14th inst., was [redacted]

and Anthropologist, they deeply regret the untimely loss of his co-operation.

As a student of the works of nature he was conscientious, accurate and thorough; as a friend he was generous, sympathetic and helpful.

The members of the Academy, while thus giving expression to their regret for the death of their associate desire to convey to his wife and children their sincere sympathy in their irreparable bereavement.

NOVEMBER 23.

The President, SAMUEL G. DIXON, M. D., in the Chair.

Seventeen persons present.

A paper entitled "The Plants of Lewis and Clark's Expedition across the Continent during the years 1804–1806," by Thomas Meehan, was presented for publication.

NOVEMBER 30.

The President, SAMUEL G. DIXON, M. D., in the Chair.

Thirty-four persons present.

A paper entitled "New and Little-known Bees from Washington State," by T. D. A. Cockerell, was presented for publication.

The death, on the 24th inst., of George H. Horn, M. D., was announced and a resolution was adopted authorizing the appointment of a committee to make arrangements for a Memorial Meeting to commemorate the services to science of Harrison Allen, M. D., and George H. Horn, M. D.

A minute from the last meeting of the Anthropological Section of a communication made by the late Dr. Harrison Allen on a method of comparing skulls was read by Mr. Chas. Morris, who was requested, in view of the fact that it is probably Dr. Allen's last contribution to science, to prepare it for publication in the Proceedings of the Academy.

Mr. J. Waln Vaux was elected a member.

Dr. Fridtjof Nansen of Christiania, Norway, was elected a correspondent.

The following was ordered to be printed:—

REPTILES FROM SONORA, SINALOA AND JALISCO, MEXICO, WITH A DESCRIPTION OF A NEW SPECIES OF SCELOPORUS.

BY JOHN VAN DENBURGH.

This paper is an enumeration of the species of reptiles contained in three small collections, and is presented in the hope that it may be of use to those who are interested in the distribution of Mexican lizards and snakes. Two of these collections are in the California Academy of Sciences: the first, gathered in Sonora by Dr. Gustav Eisen and Mr. Walter E. Bryant in April and May, 1892; the second, due to the efforts of Dr. Eisen and Mr. Frank H. Vaslit in Sinaloa and Jalisco in October and November, 1894. The third collection was secured by Dr. David Starr Jordan and a party of students at Mazatlan in December, 1894, and January, 1895, and is in the Zoological Museum of Leland Stanford Junior University.

1. **Phyllodactylus tuberculosus** Wiegm.

A fine specimen of this gecko (Cal. Acad. Sci., No. 3,389) was obtained at Matzalan, Sinaloa, in October. The California Academy possesses two specimens (248, 249) secured in Durango by Mr. C. A. [redacted]

two specimens (C. A. S. 351, 352) caught by Captain Wm. Lund on the Tres Marias. Dr. Jordan's party found the species at Mazatlan.

5. Iguana igvana rhinolopha (Wiegm.).

Three specimens were obtained at Mazatlan, Sinaloa, and four (C. A. S., 3,339–3,342) at San Blas, Jalisco.

6. Ctenosaura teres (Harlan).

This species is more numerously represented, both in the Stanford University collection and in that belonging to the California Academy, than any other species. These specimens were shot at Mazatlan, Tepic and San Blas. Many of these specimens are very large and have dorsal crests so well developed that I have no hesitation in abandoning Cope's *brachylopha* as a name for them, although I have seen no specimens from near the type locality of Harlan's *Cyclura teres.* It well may be that western specimens differ from the typical form, but until some better character has been found to separate them I cannot recognize them as distinct.

7. Crotaphytus baileyi Stejn.

One specimen was brought back from Hermosillo, Sonora.

8. Callisaurus ventralis (Hallow).

A Gridiron-tailed Lizard (C. A. S., No. 3,390) taken at Mazatlan, Sinaloa, in October, appears to be identical with Californian and Arizonan examples of this species. Its femoral pores, however, are only ten instead of from fourteen to eighteen. This locality is much farther south than any at which this lizard had previously been found. The species was found also at San Miguel de Horcasitas, Sonora, in May, 1892.

9. Holbrookia maculata approximans (Baird).

A typical specimen of this subspecies was caught at Duras Nillas, Sonora, in May, 1892. Several young from Mazatlan, January 25, 1895, are also referred to this form, although their snouts appear to be more pointed than those of Arizonan examples.

10. Uta ornata B. & G.

This lizard was obtained in Sonora at San Miguel de Horcasitas, in April, and at Duras Nillas, in May, 1892.

11. Sceloporus utiformis Cope.

Numerous specimens of this *Sceloporus* were shot at Tepic, Jalisco, in October.

12. Sceloporus pyrrhocephalus Cope.

A single young male (C. A. S., No. 3,329) agrees closely with Cope's original description of this species. It was found at Tepic, Jalisco, in October.

13. Sceloporus obscurus new species.

Two male specimens, one young and one adult, obtained at Tepic appear to differ in important characters from all known species.

Type.—Cal. Acad. Sci., No. 3,213, Tepic, Jalisco, Mexico, Gustav Eisen and Frank H. Vaslit, November, 1894.

Description.—Upper head-shields nearly smooth; enlarged supraoculars in one row, separated from mesial head-shields by a complete series of small scales; two scales on canthus rostralis; frontal divided transversely but not longitudinally; interparietal wider than long; parietals small; ear-opening with *very* slight denticulation of scales much smaller than those immediately preceding. Dorsal scales strongly keeled, sharply pointed, without marginal serrations, in nearly parallel longitudinal rows. Laterals keeled and pointed, in oblique rows, changing gradually to the larger dorsals and smaller ventrals. Twenty-eight to thirty dorsals on a line between interparietal plate and base of tail; about seven equaling length of shielded part of head. Ventrals smooth, emarginate; gulars weakly keeled, emarginate. Upper caudals considerably [redacted]

14. Sceloporus boulengeri Stejn.

A very large number of *Scelopori* collected at Mazatlan and Tepic, are certainly identical with Dr. Stejneger's *S. boulengeri*. I believe that this is the same form as Cope's *S. oligoporus*. It may even be true that these are not distinguishable from *S. horridus*, but, without an opportunity to examine the types or specimens from the type localities, it seems best to use a name of unquestionable applicability.

15. Cnemidophorus deppii lineatissimus Cope.

Two specimens (C. A. S., 3,344, 3,343) taken at San Blas, Jalisco, in October, 1894, seem typical of this lizard.

16. Cnemidophorus gularis B. & G.

A lizard caught at Guaymas, Sonora, May 12, 1892, is identical with Arizonan specimens of this species.

17. Cnemidophorus mariarum Günther.

A large number of lizards from Mazatlan, San Blas and Tepic seem to be identical with Günther's specimens from the Tres Marias Islands. Whether they are also identical with Cope's *C. communis* and Peter's *C. mexicanus* I have not been able to decide.

The upper lateral light lines are much farther apart than in *C. gularis*, causing the specimens to bear some resemblance to *C. sexlineatus*.

18. Sympholis lippiens Cope.

One typical specimen (C. A. S., 3,127) of this rare snake was taken at Tepic in October.

19. Bascanion flagellum frenatum Stejn.

The cross-bars on the neck are rather faint in a snake of this subspecies (C. A. S., 3,412) which Mr. Bryant procured at Hermosillo, Sonora, in May, 1892. This snake was brought back alive and died in San Francisco in October, 1892.

20. Bascanion semilineatum Cope.

This racer was taken by the Academy's collectors at both Tepic (Nos. 3,131, 3,132) and Mazatlan (No. 3,391) in October.

21. Bascanion lineatum Bocourt.

A single example (C. A. S., No. 3,130) with one hundred and eighty-four gastrosteges, one hundred and twenty-one urost scales in seventeen rows, was shot at Tepic in October

22. Hypsiglena torquata (Günth.).

The Academy's collectors secured a single representative (C. A. S., No. 3,394) of this species at Mazatlan.

23. Natrix valida (Kenn.).

One specimen was secured at Tepic in October.

24. Hapsidophrys diplotropis (Günth.).

Two typical specimens of this beautiful snake were obtained at Mazatlan in October.

25. Sibon punctatum (Peters).

Dr. Jordan's party secured a single snake of this species at Mazatlan. Its scale rows are nineteen and its gastrosteges one hundred and fifty-five.

26. Sibon personatum Cope.

One snake of this kind was caught at Tepic, Jalisco, in October. It has one hundred and sixty-three gastrosteges, eighty urosteges, and scales in twenty-one rows.

27. Trimorphodon biscutatus (D. & B.).

Two specimens from Mazatlan are in the Stanford University collection. They have gastrosteges 249, 250, urosteges 72, 79, scale rows 24, 25.

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SCAPHOPODA OF THE SAN DOMINGO TERTIARY.

BY H. A. PILSBRY AND BENJ. SHARP, M. D.

This account of the Scaphopods of the San Domingo tertiary strata variously denominated Miocene or Oligocene, is an outcome of investigations undertaken by the writers in the course of work upon a monograph of the Scaphopoda published in the "Manual of Conchology." It is based upon collections made by W. M. Gabb, and briefly described in the Transactions of the American Philosophical Society.

Owing probably to Gabb's illness when he prepared the palæontological part of the "Geology of San Domingo," and to his death before its publication, the study of his material seems to have been incomplete. Our examination of the material shows that of six species described or recorded by him from the beds in question, *Dentalium rudis* is the tube of a Serpuloid worm; *D. ponderosum* is, as Guppy has already claimed, a form of *D. dissimile* of the Jamaican Oligocene; *D. affine* bears a preoccupied name, and *Gadus dominguensis* is not that species, but a new one allied to the form called *Ditrupa dentalina* by Mr. Guppy. Among the specimens of the species discriminated by Gabb, and in several trays of undetermined specimens, we have been able to distinguish ten new and well-characterized forms, besides several which are probably distinct species, but being represented by young or very fragmentary individuals have been ignored in the following account.[1]

As to the age of the deposit in San Domingo furnishing these remains, and that of the same horizon at Bowden, Jamaica, there is diversity of opinion. Gabb and some others have considered it Miocene; and in view of the considerable number of species still existing in the Gulf of Mexico, and the close relationship of many of the extinct forms with living species, this estimate is not without support. Conrad, however, in 1852[2] and again in 1866[3] expressed

[1] Among these, fragments of a species probably referable to our subgenus *Episiphon* may be mentioned. This group is represented in the German Oligocene by *Dentalium ottoi* Sharp & Pils.

[2] Proc. Acad. Nat. Sci. Phila., 1852, p. 198.

[3] Check List of the Invertebrate Fossils of North America, Eocene and Oligocene. Smiths. Misc. Coll., VII, no. 200, p. 37.

his belief that the San Domingo deposit was Oligocene. This opinion has recently been re-affirmed by Dall[4] who considers the Bowden marls of Jamaica and the beds of similar age in Santo Domingo to be upper Oligocene.

In considering so small a fragment of the fauna as the *Scaphopoda* constitute, a full discussion of this question is uncalled for; the more because the Scaphopods afford no conclusive data.

Key to species of Scaphopoda.

I. Shell largest at the aperture, tapering to the apex, DENTALIUM.

a. With distinct longitudinal sculpture.

b. Circular sculpture conspicuous; tube slowly tapering.

c. Somewhat compressed; sculpture of many longitudinal cords alternating with threads, crossed by close, circular lamellæ. *D. callioglyptum.*

c'. Circular in section; sculpture of many longitudinal alternately smaller threads, crossed by regular, blunt, obliquely encircling striæ, *D. Tryoni.*

b'. Circular sculptured inconspicuous.

c. Tube markedly conical, with 6 or more ribs at apex, secondary and numerous tertiary

[redacted]

b''. Tube oval in section, compressed between the convex and concave sides; slowly tapering; moderately arcuate; smooth except for very fine growth lines, *D. præcursor.*

II. Shell contracted toward the aperture, which is smaller than the largest diameter of the tube; smooth, CADULUS.

a. Acicular, much attenuated posteriorly, the greatest diameter or "equator" very near the aperture.

b. Length 6–7 mm., about 8 times the greatest diameter, *C. phenax.*

b'. Length 8–12 mm., about 12 times the greatest diameter, *C. elegantissimus.*

a'. Slender, but not conspicuously attenuated posteriorly, the greatest diameter near the aperture, where there is a small depression on the ventral side, *C. depressicollis.*

a''. Stout and short, the greatest diameter near the anterior third of the length, gradually tapering toward each end; length about 4½ times greatest diameter, *C. colobus.*

Dentalium Cossmannianum n. sp. Pl. X, fig. 11; Pl. XI, figs. 10, 11.

Shell a hexagonal prism with slightly convex faces, slender, slowly tapering, moderately solid, glossy. Sculpture: there are 6 very narrow equidistant longitudinal threads, well raised and sharply defined, the wide intervals between them flat on the smaller end of the shell, but become decidedly convex toward the larger end; circular sculpture of rather strongly impressed annular growth marks at unequal intervals, sometimes close, sometimes distant. Aperture not preserved in the material before us, but apparently not oblique and with nearly circular peristome but slightly modified in shape by the longitudinal threads. Apex not known, but evidently hexagonal.

Length of (broken) type specimen 23 mm.; greatest diam. at larger end 3·5, at smaller end 2·7 mm.

The type has lost from the smaller end a considerable portion of its original length and probably somewhat less from the oral extremity. When perfect it probably measured not far from 45 or 50 mm. The portion remaining is perfectly characteristic, and unlike any Tertiary or living species of this region in the filiform riblets running from end to end, with wide convex intervals showing no intermediate longitudinal sculpture, or only the faintest traces of riblets in places, visible only under the lens at a certain angle of reflection. This is the form mentioned by Gabb under his remark on *D. dis-*

simile, in his paper "On the Topography and Geology of Santo Domingo," p. 244. It is named in honor of Maurice Cossmann of Paris, whose fruitful labors upon the Parisian Eocene are justly esteemed by workers upon Tertiary mollusks.

Dentalium callioglyptum n. sp. Pl. X, figs. 10, 12; Pl. XI, fig. 21.

Shell large, solid and but very slightly curved; noticeably compressed between the convex and concave surfaces; decidedly tapering. Sculpture, many longitudinal cords or riblets alternating with threads, altogether numbering about 65 near aperture, about 40 near the middle of the length, the ridges averaging about the width of the grooves; the whole crossed by circular raised lamellæ running a little obliquely around the tube; these lamellæ very close, nearly regular, most conspicuous in the intervals, and so fine that they are scarcely visible to the unaided eye. The circular lamellæ subobsolete toward the aperture in large specimens. Aperture slightly oblique, judging by the lines of growth; apex unknown; but according to the fragments before us both orifices are slightly oval in consequence of the compression of the tube.

Length unknown, but from the taper of the fragments probably about 115 mm.; greatest diam. of larger end of largest fragment 13, least diam. of same 12 mm., length 15 mm.

Another fragment from near the middle of the shell measures, length 30, greatest diam. of larger end 7·9, of smaller end 4·6 mm.; therefore tapering to the extent of 3·3 mm. in a length of 30 mm.

[redacted]

quite thick and solid. Sculpture: many longitudinal threads about as wide as the intervals, alternately larger and smaller, crossed by slightly less strong, regular, blunt, encircling striæ, rising into low granules as they cross the longitudinals; these striæ are markedly oblique, bending well forward on the concave and backward on the convex side of the shell, and toward the larger end of adults becoming irregular and, in part, obsolete. Aperture and apex not preserved, but both orifices are apparently circular. Estimated length 90 mm. in a specimen having a greatest diam, of 8·5 mm.

A fragment measures: length 36, diam. at larger end 7, at smaller end 4·7 mm.

The strongly developed and decidedly oblique encircling sculpture is conspicuous and characteristic. In *D. carduus* and *D. callioglyptum* the circular sculpture consists of sharp, raised lamellæ; in *D. Tryoni* of blunt cords, more widely spaced, and with the longitudinal riblets, enclosing rhombic depressions (Pl. XI, fig. 22). In the imperfect specimen 36 mm. long, measured above, there are 33 longitudinal cords and threads at the smaller end, double that number at the larger, where some of the threads are very small. Besides the alternation in size, there is a more or less marked tendency for every fourth riblet to be larger, on the median portion of the tube. The largest of the fragments (diam. 8·5 mm.) has about 84 subequal longitudinal threads. The increase in number of riblets is by the regular intercalation of a thread in each interval, so that at various ages a specimen would have 16, 32 and 64 riblets; the increase thereafter being confined to the convex side, where the interposed threads appear earliest at each successive increase.

In the general contour *D. Tryoni* is not unlike the living *D. capillosum* Jeffr.

Dentalium dissimile Guppy. Pl. XI, figs. 3, 4, 5.

Dentalium dissimile Guppy, Quart. Journ. Geol. Soc., XXII, p. 292, pl. 17, f. 4 (1866).
Dentalium ponderosum Gabb, see below.

This species, described by Mr. Guppy, from the island of Jamaica, is apparently identical, as Guppy has stated, with a form collected by Gabb in San Domingo. It is a member of the "group of *D. quadrapicale*" as defined by us in the "Manual of Conchology,[b]—a group distinguished by the quadrangular shape of the apex, the tube having lateral, ventral and dorsal angles posteriorly. Abund-

[b] Vol. XVII, p. 31.

antly developed in the Pacific, this type is not known to have living representatives in the Atlantic or Gulf of Mexico, although Miocene and Pliocene forms have been found in the southern United States.

In *D. dissimile* the tube is square at apex (Pl. XI, figs. 4, 5), but soon becomes circular in section. Each of the angles at and near the apex is pinched up into a narrow rounded rib. The intervening spaces are flat and plain near the apex, but soon a median thread or pair of threads arises, and a little later other threads appear in the intervals, until there are 30 to 36 threads, varying in size, in the girth of the tube. This sculpture then gradually becomes weaker, leaving the larger part of the tube cylindrical and smooth, except for circular striation (Pl. XI, fig. 3). The shell walls are unusually thick.

Ordinarily a specimen of mature growth loses a great part of the sculptured portion by truncation, so that the square section of the earlier part of the tube is hardly noticeable. This was the case with Guppy's type. The other characters of this species may be seen by reference to the figures here given and to Guppy's original description and figure.

Var. ponderosum Gabb. Pl. X, figs. 1, 2, 3; Pl. XI, figs. 15, 16.

D. ponderosum Gabb, Trans. Amer. Philos. Soc. (N. Ser.), XV, p. 244 (1873).

Larger, heavier, excessively solid, the cavity reduced to a small perforation by the excessive thickening of the shell. Quadrate form [redacted]

ribs, for the greater part are decidedly smaller than these, and attain or fall short of the apex according to the age and consequent degree of posterior truncation. In the secondary intervals there arise a variable number of tertiary threads, generally one, two or three in each space; and at the aperture there is much variation in the number of riblets and threads, different specimens having 36, 40, 52, etc. In perfectly preserved shells there is seen an excessively fine but clear cut longitudinal striation in addition to the coarser sculpture described. Growth-striæ fine, inconspicuous and oblique. Aperture slightly oblique, circular, the peristome bevelled to a thin edge. Apex rather wide, the orifice subcircular, with a minute notch on the convex side.

Length 41·5, diam. at aperture 7·4, at apex 2·3 mm. The largest specimen measures 8 mm. diam. at aperture.

A large, solid and markedly conical species, with very little curve, and that mainly quite near the apex. It is somewhat like *D. disparile* on a very large scale, and, as in that species, the number of ribs at the apex is subject to considerable variation, although the fundamental form is hexagonal, the tube soon becoming circular. *D. thalloides* Conrad of the Claiborne Eocene lacks the fine, clear-cut longitudinal striation of this species, and, moreover, tapers much less rapidly.

Gabb's diagnosis, published after his death, is not very full, and he gave no figure. As the name imposed by him is preoccupied, we have considered it best to present a detailed description, in proposing a new name for the form.

Dentalium haytense Gabb. Pl. XI, figs. 8, 9.

D. haytensis Gabb, Trans. Amer. Philos. Soc. (N. Ser.), XV, p. 244 (1873).

Known only by fragments, the largest of which is probably one-half the original length. These indicate an almost straight, rather rapidly tapering but slender shell, circular or nearly so in section, with smooth, polished surface; growth-wrinkles light, rather irregular, running somewhat obliquely around the tube; and there is an occasional constriction so slight as to be hardly mentionable. No trace of longitudinal sculpture. Shell moderately thick (as shown by the section, fig. 8), but becoming very thin at the aperture. Apex unknown.

Length of type (broken at both ends) 9·4, diam. at larger end 1·28 x 1·35, at smaller end 0·68 mm.

This is one of those simple species of the subgenus *Lævidentalium* which has no prominent specific characters. It is still readily distinguishable from other smooth forms of the Miocene or Oligocene of this region. *D. pyrum* is, perhaps, nearest, but that has a distinctly ovate or pear-shaped section.

Dentalium pyrum n. sp. Pl. XI, figs. 6, 7.

Fragments, by which alone this species is known to us, indicate a shell of slight curvature and slow increase; thin; distinctly ovate in section, compressed laterally, the narrow end of the egg-form toward the concave side. Surface smooth except for light growth-lines, polished. Apex with a narrowly oblong orifice, passing into a short, narrowly V-shaped notch on the convex side of the tube; the orifice, except at the slit, surrounded by an erect sheath.

Length of largest fragment 6·45, greatest diam. at larger end 1·8, least 1·65 mm.; diam. at smaller end 1·3 x 1·4 mm.

The apical characters are exactly as in the recent Antillean *D. perlongum* and *D. matara* Dall. It is the typical *Antalis* apex.

Dentalium præcursor n. sp. Pl. XI, figs. 12, 13, 14.

Shell small, thin, slowly tapering, moderately arcuate, compressed between the convex and concave sides, the section therefore oval. Surface smooth except for very fine growth-lines, without longitudinal sculpture. Dimensions of type, which is broken at both ends: length 5·6, transverse or greatest diam. at larger end ·95, least ·85 mm.

[redacted]

Exceedingly similar to *C. dentalinus* Guppy, of the Jamaican Oligocene,[7] but easily distinguished by the lack of circular riblets upon the smaller half of the tube. It differs in form from all of the smooth species of the same group. We have examined a great many specimens.

This is *Gadus dominguensis* of Gabb's paper; not of d'Orbigny.

Cadulus elegantissimus n. sp. Pl. XI, figs. 28, 29, 30.

Shell similar to the preceding, but larger, much more elongated. Tube compressed vertically, very obliquely but indistinctly striated, glossy. Greatest diameter close to the aperture; contraction rather slight. Aperture oval; anal orifice oval, nearly circular.

Length 11·75 mm.; greatest antero-posterior diameter of tube 0·65 mm.

A smaller specimen measures, length 8·75, greatest antero-posterior diam. 0·7 mm.

Two perfect specimens and several broken ones were included by Gabb in his lot of "*Gadus dominguensis.*" It is excessively slender, quite arcuate, and decidedly longer and larger than *C. dentalinus* Guppy. The measurements are from the largest of the unbroken shells. Fragments indicate that somewhat larger individuals occur.

Cadulus depressicollis n. sp. Pl. XI, figs. 25, 26, 27.

Shell long and slender, arcuate, much compressed between the concave and convex sides throughout. Regularly and slowly enlarging from the apex nearly to the aperture, then noticeably contracted on all sides; on the middle of the convex side having a distinctly depressed, concave area about one-third the width of the shell, and extending from the peristome backward a distance about equal to the greatest diameter of the aperture; surface smooth and glossy. Aperture oblong; apex oblong, simple, with subcircular orifice.

Length 11·75 mm.; greatest diam. of tube 1·63, least diam. at same point 1·25 mm.; aperture, greatest diam. 1·06, least 0·8 mm.

This was one of the four species discriminated, upon separating Gabb's tray of *Gadus dominguensis* into its elementary constituents. With *Cadulus dentalinus* Guppy, *C. dominguensis* d'Orb., and the various forms associated with it, *C. depressicollis* has no close relationship. It is slender for a *Cadulus*, and remarkable for the

[7] Manual of Conchology, XVII, Pl. 36, figs. 1, 2.

decidedly concave area on the flattened surface adjacent to the lip on the convex side.

Cadulus colobus n. sp. Pl. XI, figs. 17, 18, 19, 20.

Shell small, thin, moderately curved, rather short and stout, but slightly swollen. Greatest girth at about the posterior third of the length of the tube, slowly tapering to the rather large apex, the anterior contraction equally gradual. Posteriorly the tube is strongly compressed vertically, but at the "equator" and aperture it is nearly circular in section; surface polished. Aperture circular, not oblique. Apical orifice transversely oval.

Length 2·95 mm.; diameter at "equator," antero-posterior 0·658, lateral 0·688 mm.; diam. at apex, antero-posterior 0.24, lateral 0.33 mm.; diam. of aperture 0·55 x 0·58 mm.

C. colobus is a much smaller and more "stumpy" species than *C. parianus* Guppy of the Trinidad Oligocene. It is very unlike *C. dentalinus, elegantissimus* or *depressicollis*. It was found with Gabb's lot of "*Gadus dominguensis.*"

VERMES—SERPULIDÆ.

"**Dentalium rudis**" Gabb. Pl. X, figs. 4, 8.

? *Dentalium rudis* Gabb, Trans. Amer. Philos. Soc. (n. ser.), xv, p. 244 (1873).

[redacted]

In the present condition of the literature upon tubicolous worms, it is impossible for us to determine the generic position of these remains, but we take them to be something of the nature of *Ditrupa*, *Hamulus* or *Pyrgopolon*; the massive, sculptured tube being not unlike the Cretaceous groups mentioned.

EXPLANATION OF PLATES.

Plate X.

(All figures natural size).

Figs. 1, 2, 3. *Dentalium dissimile* var. *ponderosum* Gabb.
Fig. 4. "*Dentalium rudis*" Gabb. Fragments of three individuals.
Fig. 5. *Dentalium Tryoni* n. sp.
Figs. 6, 7. *Dentalium Gabbi* n. sp.
Fig. 8. "*Dentalium rudis*" Gabb. Fragment.
Fig. 9. *Dentalium Tryoni* n. sp.
Figs. 10, 12. *Dentalium callioglyptum* n. sp.
Fig. 11. *Dentalium cossmannianum* n. sp.
Fig. 13. *Dentalium Gabbi* n. sp.

Plate XI.

Figs. 1, 2. *Dentalium Gabbi* n. sp. Enlarged view of the apex.
Fig. 3. *Dentalium dissimile* Guppy. Enlarged view of anterior portion.
Fig. 4. *Dentalium dissimile* Guppy. Enlarged view of posterior end.
Fig. 5. *Dentalium dissimile* Guppy. Enlarged view of apex.
Fig. 6. *Dentalium pyrum* n. sp. Enlarged view of aperture.
Fig. 7. *Dentalium pyrum* n. sp. Ventral aspect, enlarged.
Fig. 8. *Dentalium haytense* Gabb. Aperture, enlarged.
Fig. 9. *Dentalium haytense* Gabb. Lateral aspect, enlarged.
Fig. 10. *Dentalium Cossmannianum* n. sp. Lateral aspect of anterior portion.
Fig. 11. *Dentalium Cossmannianum* n. sp. Section, enlarged.
Fig. 12. *Dentalium præcursor* n. sp. Aperture, enlarged.
Fig. 13. *Dentalium præcursor* n. sp. Lateral aspect, enlarged.
Fig. 14. *Dentalium præcursor* n. sp. Dorsal aspect, enlarged.

Figs. 15, 16. *Dentalium dissimile* var. *ponderosum* Gabb. Two sections of one individual (Pl. X, fig. 2) enlarged.

Fig. 17. *Cadulus colobus* n. sp. Dorsal aspect, much enlarged.

Fig. 18. *Cadulus colobus* n. sp. Aperture.

Fig. 19. *Cadulus colobus* n. sp. Lateral aspect.

Fig. 20. *Cadulus colobus* n. sp. Anal orifice.

Fig. 21. *Dentalium callioglyptum* n. sp. Sculpture, much enlarged.

Fig. 22. *Dentalium Tryoni* n. sp. Sculpture, much enlarged.

Figs. 23, 24. *Cadulus phenax* n. sp. Lateral aspect.

Fig. 25. *Cadulus depressicollis* n. sp. Outlines of aperture and "equator."

Fig. 26. *Cadulus depressicollis* n. sp. Lateral aspect.

Fig. 27. *Cadulus depressicollis* n. sp. Ventral aspect.

Fig. 28. *Cadulus elegantissimus* n. sp. Lateral aspect.

Fig. 29. *Cadulus elegantissimus* n. sp. Outline of aperture.

Fig. 30. *Cadulus elegantissimus* n. sp. Lateral aspect.

NEW BRAZILIAN STREPTAXIDÆ.

BY HENRY A. PILSBRY.

In the course of identifying Brazilian *Streptaxidæ* some time ago, my attention was called to the fact that in the collection of the Academy there were several different and very distinct species labelled "*Streptaxis candidus* Spix," mainly in the "Robert Swift" and "A. D. Brown" collections. I was thus induced to reexamine the large species of the group *Artemon*, to which these forms belong, and to investigate their characters and literature.

Tryon[1] enumerates the following species: *S. candidus* Spix (including *S. Spixianus* Pfr.), *S. intermedius* Alb., *S. regius* Lobbecke, *S. wagneri* Pfr., *S. Rollandi* Bern., *S. Paivanus*, *conoideus*, *costulosus* and *cypsele* Pfr., *S. apertus* and *depressus* Martens.

S. regius, *Rollandi* and *cypsele* I have not seen. The identity of *S. candidus* Spix with *S. Spixianus* Pfr. is very uncertain. There is nothing in the collection of the Academy altogether fulfilling the requirements of the Spix-Wagner description, which indicates a broadly umbilicated shell, of 25 mm. diam. and half that height. The larger size of Pfeiffer's shell is of course not significant, for most of these species periodically form expanded lips, which, with further growth, remain visible, varix-like, on the base of the shell; so that the size of apparently mature examples is not a safe specific criterion.

The following forms seem to be new:—

S. helios n. sp.

Shell depressed, with low-conoid spire, umbilicate, the umbilicus deep and somewhat funnel-shaped, one-fifth the diameter of shell; rather thin and not very strong, buff tinted; the surface with varnish-like gloss, very smooth, with only a faint puckering below the suture representing the costulation of the allied species. Apex minute, smooth; whorls fully 6½, moderately convex, at first slowly, then more rapidly increasing, the last decidedly wider than the penultimate (viewed from above), well rounded at the periphery, convex beneath, very obtusely subangular around the umbilicus.

[1] Manual of Conchology, (2), I, pp. 61-63.

Aperture oblique, roundly crescentic, the width hardly exceeding the height; peristome thin, but very slightly expanded below, the columellar margin expanded, slightly recurved, but little impinging upon the umbilicus;

Alt. 15, greater diam. 24, lesser 21·7 mm.; width of aperture 11, height 11 mm.

Brazil.

Smoother above than any of the other large species. Perhaps Pfeiffer's "*Streptaxis candida* var.," Chemnitz, edit. 2, *Helix*, Pl. 103, f. 29, 30, is this species; but in fig. 29 the basal lip is less deeply rounded than in typical *helios*.

S. tumulus n. sp.

Shell subglobose-depressed, umbilicate, the umbilicus deeply penetrating, cylindrical or well-like, one-seventh the diameter of shell; solid; white or yellowish with brilliant gloss, the upper surface sculptured with smooth, regular, slightly arcuate, rounded costulæ, wider than their intervals, and on the last whorl about 2½ in the space of a millimeter; becoming obsolete at the periphery, the base being smooth with the luster of varnish. Spire low dome-shaped, the earlier whorls slightly conic. Whorls 7, very slowly increasing, the last scarcely wider than the penultimate (viewed from above), rounded at periphery and convex beneath, showing two slight vari-

[redacted]

face slightly shining, very finely and closely costulate-striate throughout, the costulæ clear-cut but minute, about 5 in the space of a millimeter, on the last whorl; becoming lower and fainter on the base. Whorls 6 to 6½, convex, at first slowly, then more rapidly increasing, the last decidedly wider than the penultimate, rounded at the periphery, obtusely angular around the somewhat funnel-shaped umbilicus. Aperture rounded lunate, oblique; outer and basal margins of peristome slightly expanded, columellar margin dilated above; basal margin slightly bent forward in the middle.

Alt. 13·5, greater diam. 21, lesser 18·3 mm.; width of aperture 11, height 9·5 mm.

Alt. 12·5, greater diam. 20·5 mm.

Province of Bahia, Brazil.

Resembles *S. Spixianus* in form, but the series of a half dozen specimens before me differs constantly from that species in the smaller size of the shells and the extremely fine striation.

S. decussatus n. sp.

Shell depressed-turbinate, narrowly umbilicate, the umbilicus deep and well-like, one-ninth or one-tenth the diam. of shell; moderately solid; pale yellowish. Surface glossy, closely and finely costulate above, the costulæ wider than the intervals, about three in the space of a millimeter, and decussated by numerous fine spirals, which cut or indent them but do not appear in the intervening grooves; the base similarly but less strongly costulate. Spire low conoid, with the lateral outlines but slightly convex, apical whorls costulate; whorls 6½, at first slowly, then more rapidly widening, the last bluntly but conspicuously angular at the periphery, convex beneath, angular around the umbilicus. Aperture rhombic, somewhat oblique, angular at middle of outer margin and at junction of the basal with the columellar margin; peristome unexpanded, becoming slightly so below, the columellar margin vertical, dilated above, impinging upon the umbilicus.

Alt. 16, greater diam. 22, lesser 20 mm.; width of aperture 12, height 11 mm.

Brazil.

Peculiar in the decussated sculpture and continuation of the costulation to the apex. The angular periphery and verge of the narrow umbilicus are also conspicuous features.

DECEMBER 7.

The President, SAMUEL G. DIXON, M. D., in the Chair.

Twenty-eight persons present.

Papers under the following titles were presented for publication :—

"Descriptions of two new forms of Perideris," by Henry A. Pilsbry.

"Synopsis of the recent Psammobiidæ of North America," by W. H. Dall.

"The Gerrhonotus of the San Lucan Fauna of Lower California with diagnoses of other West American Species," by John Van Denburgh.

"The Petrifaction of Bones," by E. Goldsmith.

DECEMBER 14.

The President, SAMUEL G. DIXON, M. D., in the Chair.

Forty-four persons present.

DECEMBER 21.

The President, SAMUEL G. DIXON, M. D., in the Chair.

[redacted]

iella. This union I have proven to be inadmissible on the ground of the totally different dentition of the radula.

Professor Tate's note, therefore, does not in the least affect the conclusions reached in my paper, viz., that *Tatea* is a valid genus of *Amnicolidæ;* that it is not at all closely related to the *Rissoininæ;* and that it is not equivalent to the genus *Eatoniella.*

It only remains to add that the paper of my esteemed colleague may be consulted with advantage for the full specific synonymy, and for details of the external anatomy of *Tatea* not given in my own communication.

DECEMBER 28.

GENERAL ISAAC J. WISTAR in the Chair.

Thirty-six persons present.

A paper entitled "Odonata (Dragonflies) from the Indian Ocean and from Kashmir collected by Dr. W. L. Abbott," by Philip P. Calvert, was presented for publication.

The following was offered from the Anthropological Section:—

The Anthropological Section of the Academy of Natural Sciences views with the deepest regret the untimely death of its late able and esteemed Director, DR. HARRISON ALLEN, to whose earnest efforts the organization and subsequent success of the Section were mainly due and who served it as Director from its first meeting until his decease. Dr. Allen's broad interest in the science of anthropology in general and his valuable series of studies in the characteristics of human crania in particular, were indicated by numerous communications to the Section, of which one, on a new method of estimating the comparative measurements of skulls, given in October, 1897, was probably his last communication before any scientific body. The high value and wide diversity of his scientific work, the originality and suggestiveness of many of his views and the deep earnestness of his devotion to scientific research render his death a serious loss to the world of science as a whole, and in particular to the institutions with which he was intimately connected. By the Anthropological Section it is felt to be a loss which cannot easily be repaired.

The communication above alluded to has been rèported as follows:—

Comparative Measurements of Skulls.—At the meeting of the Anthropological Section of the Academy, held October 8, 1897, Dr. Harrison Allen presented a number of Hawaiian skulls, placed in his hands by Dr. Whitney, who had enjoyed exceptional opportunities for their collection. It had been found, he said, that the Hawaiian people of high caste selected different burial places from those of low caste, the former choosing caves as places of sepulture, the latter interring their dead on the sea coast. This custom renders it easy to divide the skulls into two classes, whose distinction is also indicated in their characteristics. He had found, on comparison of these classes of skulls, that they presented well-marked distinctions, not due to any difference of race, but simply to different habits and conditions. The skulls of high caste origin were found to have characters due, in his opinion, to higher intelligence and more luxurious habits of living than those belonging to the lower caste, all the differences observed being probably referable to these causes.

In comparing these characters he adopted a special method, constituting a modification of the ordinary method. Instead of indicating variations by curves, he arranged the numbers representing the measurements of significant features in the series of skulls, in steps, or terraces, each step indicating by its width the degree of preponderance of its corresponding number. Omissions in the series of numbers were likewise indicated. He considered this [redacted]

NOTES ON LIVING AND EXTINCT SPECIES OF NORTH AMERICAN BOVIDÆ.

BY SAMUEL N. RHOADS.

Through the courtesy of his friend Stewart Culin, of the Department of Archeology and Paleontology, University of Pennsylvania, the author has been permitted to examine a collection of mammalian fossils forwarded from Alaska to the University.

These fossils were collected "on the tundra, back of Point Barrow," a locality from which no mammalian fossils appear to have been previously recorded, and situated 500 miles farther north than the celebrated Elephant Point fossil beds on the shores of Eschscholtz Bay.

They comprise numerous parts of the skeletons of *Elephas*, together with the skulls of three individuals of the genus *Bison*, all in an unusually good state of preservation. In identifying these for Mr. Culin it was found necessary to make comparisons with the type specimens of *Bison* in the Museum of the Academy of Natural Sciences of Philadelphia. The results of this study appear to warrant publication, affecting as they do the question of the relationships of *Bison latifrons* (Harlan), *B. antiquus* Leidy, *B. alleni* Marsh and *B. crampianus* (Cope).

The two smaller specimens, Nos. 13,752, 13,753 of the University Museum Catalogue, undoubtedly represent the smaller extinct bison of N. America, named in 1854 by Richardson, *Bison crassicornis*, from specimens taken at Eschscholtz Bay, Alaska. The smaller of these two specimens, No. 13,752, is from an adult animal, probably a male, of four or five years. The fronto-parietal and occipital portions of the skull from the posterior line of the orbits to the basi-occipital inclusive, are intact, as also the horn-cores. The distance from tip to tip of horn-cores is 812 millimeters. The frontal breadth between the bases of horn-cores is 318 mm. Specimen No. 13,753 is a skull in much the same condition as the preceding, excepting the horn-cores, whose terminal thirds have been destroyed. It belongs to an older animal than No. 13,752, the frontal breadth between the bases of horn-cores being about the same as in that speci-

men but the interorbital width is 325 mm. greater. The horns of both these specimens agree closely in size, curvature and relative dimensions with the larger horn-core and attached frontal bone forming the type of Leidy's *Bison antiquus* from Big Bone Lick, Kentucky.

Dr. J. A. Allen, in his Memoir of the American Bisons,[1] not only shows the specific differences of the smaller extinct bison of America from the living animal, but establishes the priority of Leidy's name *antiquus* over Richardson's *crassicornis*, and shows that both these names were, with little doubt, applied to the same species. In the Museum of the Academy is the most complete cranium of fossil American bison[2] yet recorded (Pl. XII, fig. 2). It was sent to Dr. Leidy by Messrs. Calvin and Wilfred Brown, who discovered it in the Pilarcitos Valley near San Francisco, Cal. It is classed by Leidy under *latifrons*, to which he subsequently referred his *antiquus* specimens. Its relations to the existing bison are much closer, however, than to Leidy's type of *antiquus*. A comparison of the type of *antiquus* from Big Bone Lick with the newly acquired specimens from Alaska, confirms the views of Dr. Allen and Prof. E. D. Cope,[3] viz., that we have in *B. antiquus* a near prototype of the existing bison. In *antiquus* the stout, subcircular horn-cores have first a lateral growth at right angles to the longitudinal axis of the skull (or directed slightly backward) and on a level with (or slightly below) the frontal plane, rather abruptly curving upward along their [redacted]

d, the vertical and longitudinal (transverse) diameters of the horn-cores of *B. bison*, measured at one-third of the distance of whole length of core from base of same, are about equal, and the superior (concave) surface of core well rounded, in *B. antiquus* the longitudinal diameter is much the greater, and the superior (concave) surface of core more or less flattened.[4]

The third, and by far the most interesting, of all the Alaskan specimens loaned by Mr. Culin, is a large cranium of a long horned fossil bison (No. 13,754), in which the frontal and occipital portions, with their horn-cores, are intact. The upper margins of the orbits and the basal suture of the nasals are also present. The specimen is evidently of a fully adult male animal, and is much the best preserved and strongly fossilized example of bison that has come to hand. In the latter respect it is in strong contrast to the other bison specimens which accompanied it from Alaska, or, in fact, with any in the entire series now at the Academy. As compared with the *antiquus* skull from Alaska already mentioned, it is more thoroughly mineralized, and shows but slight traces of the water-worn appearance so evident in the latter. Its specific gravity is 1½ to 1¾ times that of the *antiquus* specimens. Whether they all came from the same site and geological horizon we have no source of information, but the comparatively recent characters of the *antiquus* skulls, their color and frangibility, bespeak a much later age and indicate a surface exposure to the elements, so that they do not greatly differ in character from the weathered skulls of recent Musk Ox sent to the University from Alaska in the same shipment. The large-horned specimen, which may, for the present, be referred to as number 13,754, shows, in the size and curvature of its horns, a very different type of bison from either *B. bison* or *B. antiquus*, in these and other respects indicating their closer relation-

[4] In the type of *antiquus* this flattening is very marked, as also in the Alaskan specimens. In Leidy's California specimen the flattening is very slight, and in cross section the horn differs very little from *B. bison*. Indeed, this specimen in this regard is so different from the type of *antiquus* and from all the *antiquus* specimens from Alaska as to raise the question of their specific identity.

Just before this article went to the printer, the author consulted a valuable paper in the Kansas University Quarterly for July, 1897, on the osteology of *B. antiquus*, by Alban Stewart. While Mr. Stewart unfortunately makes no comparisons between his fine skull of *antiquus* and other American fossil species, and omits to mention many characters which are essential in such comparisons, his paper brings out some strong distinctions between typical *antiquus* and *B. bison* hitherto only conjectured because of the fragmentary state of all other specimens.

ship to the huge-horned *B. latifrons* of Harlan, the type of which is in the Museum of the Academy. It is, however, a much smaller-horned species, and the horn-cores are much more curved and flattened than in *latifrons*. The difference in the size of the cranium in the two species is not great, the frontal breadth being the same, but the greater breadth and massive development of the occipital region in *latifrons* is very noticeable, a difference necessitated by the great relative weight of the horns and the consequent development of the cervical muscles and their attachments at the base of the cranium. The species to which No. 13,754 shows closest relations is *B. crampianus* of Cope, recently described,[5] from the Pleistocene of Kansas, the type of which is also in the Museum of the Academy.

The horn-core and rostral portion of cranium which represent this species are intermediate in size and characters between *latifrons* and No 13,754.

As pointed out by Prof. Cope, the characters separating *latifrons* from *crampianus*, based solely on the horn-cores, are, without much doubt, specific, the difference in size alone amounting to 40 per cent., while in curvature and the relative dimensions of cross section the distinctions are equally pronounced.

It therefore remains to consider the status of the Alaskan specimen with regard to *crampianus*. Before doing so, however, the question of sexual differences in the development of the horn-cores of the genus *Bos* and *Bison* should be considered. Dr. Leidy, in

[redacted]

horns between males and females in living species of the genera *Bos* and *Bison*. A comparison of males and females in old world species of *Bos*, as *B. indicus*, *B. caffer* and *B. grunniens*, not only confirms the diagnosis of the bovine section of the *Bovidæ* made by Flower and Lydekker:[6] "horns of nearly equal size in both sexes," but shows also the relative position of the horns to the skull and their curvature is subject to no specific sexual variations. In the existing American Bison, to which all the fossil remains of Nearctic species appear more closely related than to the Palearctic species, we have excellent opportunities to determine the sexual characters of the horns from very large suites of specimens in several of our museums as well as among herds of the living animals. Of the latter the author has examined the herd of the Philadelphia Zoological Society, in which about twenty individuals, including six adult females, are represented. Without exception, these females prove that the only difference between male and female bison horns is in the smaller basal calibre of the latter. With respect to curvature and angle of growth from the skull they are singularly like the males in the same herd. With respect to length, the maximum female horn fully equalled the longest of any male horn examined, in this respect showing a length relative to the size of body about 20 per cent. greater than in the male.[7] With respect to the shape of the horn-cores in the two sexes, those of the female are more cylindrical throughout, almost entirely lacking the slightly flattened contour exhibited by the superior surface of male horn-cores.

It would seem fair to assume, therefore, where there is no evidence to the contrary, that the extinct species of *Bos* and *Bison* were analogous to our existing forms in respect to the slight differences between the horns of males and females of the same species, and that marked differences in size and diametric proportions of the adult horn-cores, making due allowance for the more slender and cylindrical character of the female horn, are diagnostic specific characters. On this basis we will return to a comparison of the horn-cores of the Alaskan skull, No. 13,754, with Cope's type of *B. crampianus*. The basal processes of the left horn-core of *crampianus* are wholly wanting, but the contour lines and sulcations of the original parts indicate that but a small portion of the base of the core is missing.

[6] Mam. Liv. and Extinct, 1891, p. 360.

[7] The relative length of sheath to core is greater in females than in males, so that the cores of females average shorter than males of same age.

A conservative estimate of the original length of the horn-core, adding two inches (50 mm.) to the broken apical portion and two more for the basal part, makes it 800 mm. when measured along its posterior arc on a plane with the occiput; the same measurement in No. 13,754 is only 520 mm. The girth of core of *crampianus* measured half way from base to tip, where the specimen is best preserved, is 305 mm., while that of No. 13,754 is 241 mm. These dimensions show that in *crampianus* we have a species bearing horns more than $\frac{1}{3}$ heavier and longer than the large-horned Alaskan animal, and in this respect showing a difference out of all proportion to the greatest known difference shown by adult males and females of the same species in existing bisons. Examining next the shape of the horns in the specimens under consideration we note a striking difference, quite sufficient when present in living species, to denote specific values. The greatest diameter of the horn-core of *crampianus*, measured at a point half way between base and tip, is 105 mm., the least diameter 92 mm., the first of these measurements being taken along a line parallel to the facial plane and the second at right angles thereto. In No. 13,754 these measurements are respectively 88 mm. and 67 mm., showing the greater superior flatness of the horns of the Alaskan animal. A median cross-section of the core of *crampianus*, in the words of its describer, " is a triangle, with a broadly rounded apex." It is more properly a truncated oval or ellipse, the flattened or hollowed truncate portion corresponding with the posterior face of the core. In No. 13,754 the same section presents a rounded hemispheric out- [redacted]

showing the relations of *crampianus* to No. 13,754 will, of course, equally apply to *B. alleni*. The use of *crampianus* in the above comparisons was necessitated by the writer's inability to procure the type of *alleni*.

Prof. Marsh also described on the same page of the American Journal two horn-cores of another and smaller and straighter-horned bison from the lower Pliocene of Nebraska which he named *Bison ferox*. Its specific distinction from *B. alleni* is, perhaps, well-founded (although it is not enough smaller than that species not to be its female), because of the straightness of its horns. In this respect and in its much greater size it is, without a doubt, a different species from that represented by the large Alaskan specimen No. 13,754. Both *ferox* and *alleni*, of course, are not comparable to *latifrons*, and both are as equally removed from *antiquus* (= *crassicornis*) as *crampianus* has been shown to be.

Before making a final decision as to the status of this large Alaskan specimen it remains to consider some important questions of synonymy and identity arising from the original description and figures of *crassicornis*.

Richardson's species *crassicornis*, as originally described in the "Zoology of the Voyage of the Herald," is founded primarily on the skull formerly secured by Captain Beechey at Eschscholtz Bay and figured by Buckland in the appendix to Beechey's Voyage. This skull is figured by Richardson on Plate IX of his work, no other reference being given in the headline of his article on this species (p. 40). On page 42 he enumerates a "No. 91," stating: "This number indicates the *large horn-core*, of which a side view on the facial aspect is given in Plate XIII, fig. 1, and a view of the coronal aspect in fig. 2, both of the natural size." On the next page he refers to this specimen, stating, after a comparison with other remains from Alaska and with *Bos primigenius*—"it has therefore been considered a horn-core of an older and probably a male individual of the race that produced the skull marked No. 1 A, and to which, from the thickness of its horns, I have given the distinctive epithet of *crassicornis*."

Leidy, Allen and others have already almost conclusively shown that *crassicornis*, based on the Beechey specimen as a type, is a synonym which must yield priority of publication to *antiquus* of Leidy.

The fine series of specimens of fossil bison now in the Academy of Natural Sciences of Philadelphia confirms this conclusion. But

a comparison of the figures of the large horn-cores on Plate XIII of Richardson's work, which he also refers to *crassicornis*, shows unmistakable similarity to the horn-cores of the large-horned Alaskan specimen from the University of Pennsylvania, No. 13,754. Not only is the shape and curvature of these horn-cores, as figured by Richardson, remarkably similar to those of No. 13,754, but the measurements of the latter coincide almost exactly with those given for the former. Indeed it would be almost impossible in a series of hundreds of such skulls to find two individuals so nearly alike.

As has already been pointed out, we cannot account for the difference between Richardson's type skull of *crassicornis* and the large horn-cores which he attributes to a male of the same species, on the ground of sex. There is little doubt that the Beechey type specimen of *crassicornis* is of a male, and that the small, rounded horn-core, which Richardson figured on Plate XIII in contrast with the large ones under the name " *B. priscus*," is of a female *antiquus* (=*crassicornis*). An exactly similar specimen of same size and curvature with its accompanying sheath is in the collection of the Academy, being presented by Dr. B. Sharp, who secured it at Elephant Point, Kotzebue Sound, Alaska. It is also worthy of mention that these supposed female horns show a close analogy in their slenderness, length and deep sulcation of cores as compared with that of the [redacted]

Syn. *Bison crassicornis* Richardson, Zool. Voy. Herald, 1854, pp. 42, 43, Pl. XIII, figs. 1 and 2 (including solely the references to large ♂ horn-core "No. 91").

General characters.—Size intermediate between *B. antiquus* and *B. alleni*; frontal breadth equalling that of *B. latifrons*, the occipital development much weaker. Horn-cores strongly curved upward and forward, their tips reaching behind the plane of the occiput; greatly flattened and smooth superiorly, broadly rounded and deeply furrowed inferiorly, showing a rounded hemispheric outline in median cross-section as contrasted with type of *crampianus* (= *alleni*). Frontal and occipital characters as in *B. bison* and its other extinct allies, when contrasted with Old World forms. Ratio of length of single horn-core to breadth of frontals between horn-cores much smaller than in type of *crampianus*[1] (=*alleni*) and *latifrons*. Ratio of greatest median diameter of horn-core to the least median diameter of same, much less than in any known American species of bison. For more detailed comparative characters consult the preceding pages of this paper.

Measurements.—Greatest extent of horn-cores, measured between tips, 1,130 mm.; chord of arc of left horn-core from tip to superior base, 405 mm.; shortest frontal width between basilar processes of horn-cores, 465 mm.; greatest interorbital width, 400 mm.; length from basal suture of nasals to posterior edge of occipital crest, measured along mesial frontal profile, 333 mm.; greatest mastoid breadth, 308 mm.; vertical height of occiput, from lower border of foramen magnum to highest point of occipital crest, 174 mm.; greatest width between the outer edges of the lateral wings of the condyles, 162 mm.; girth of frontal shoulder of left horn-core, measured 20 mm. from basal border of core, 349 mm.; greatest girth of left horn-core, measured along basal border, 410 mm.; girth of left horn-core at a point 200 mm. from its inferior basal border, 241 mm.; greatest diameter of core at same point, 86 mm.; least diameter of core at same point, 66 mm.; length of left horn-core measured along superior arc (adding 15 mm. for portion of tip worn off), 497 mm.; the same measured along inferior arc of same, 526 mm.

Habitat and Geologic Position.—Northern Alaska (and British America?) from Kotzebue Sound northward; living in early Plistocene time, anterior to but perhaps overlapping the existence of the

[1] Judging by the dimensions of the antorbital section of the type of *crampianus*, its cranium was about the same size as those of *alaskensis* and *latifrons*.

more southern *B. antiquus*, whose remains are found in the same deposits along the southern range of *alaskensis*.

Note on "Bison appalachicolus" Rhoads.

In the Proceedings of the Academy of Natural Sciences of Philadelphia for the year 1895, pages 246 to 248 inclusive, the writer described the horn-core of a fossil bovine from a limestone cave in Pennsylvania as a new species, under the above name. A more critical examination of the type of *appalachicolus* suggests the following remarks:

The portion of the frontal plate attached to horn-core presents us with a sagittal suture showing that the forehead of this animal was smooth and nearly level between the horn-cores, that the width of the skull at this point was only 90 millimeters, and that there was a well defined, low, osseous prominence along the sagittal suture. These and other characters of the type bespeak a fully adult animal. A fragment originally associated with the type, from the character of the matrix and its label, contains a nearly perfect cross-section of the more distal portion of the same horn-core. At its smaller end this piece of core measures transversely 48 by 40 mm. It indicates a horn-conformation approaching more nearly to *Ovibos* than *Bison*, in this respect verifying the supposed affinity of the specimen to the musk ox rather than to the bison. The charac- [redacted]

Slave Lake, and the eastern base of the Rocky Mountains in Athabasca, has been asserted by hunters and travellers in this portion of the great northwest. Many have been the opinions of naturalists as to the relations of this so-called "Wood Buffalo" to its congener of the plains, the *Bos bison* of Linnæus and the *Bos americanus* of Gmelin and subsequent authors generally. Unfortunately the subject has, up to the present time, never got beyond the domain of hearsay, theory and hunter's stories, because no undoubted specimen of typical Wood Buffalo has been made a basis for the critical determination of its characters as compared with the buffalo of the more southern plains and prairies. In searching among the literature touching upon the Wood Buffalo this radical deficiency became more and more apparent, and it was with no small satisfaction that the writer succeeded in discovering, through correspondence with his friend, Professor J. Macoun, of the Canadian Geological Survey, that a specimen of an adult male Wood Buffalo had recently been added to their museum at Ottawa. The characters of this specimen sufficiently confirm the more trustworthy statements of those who have had a field acquaintance with the Wood Buffalo to show its claim to recognition as a well defined race of *Bison bison*. Nor is this to be wondered at when we consider the decidedly different environment and habits of this northern race, and from what we know of other American mammals living in similar conditions, the differentiation between the two had practically become a foregone conclusion.

Before giving a detailed description of the Wood Buffalo it will be of use to the reader to know something of its literary history. Among the earliest notices we have of the existence of the American bison in the limited area now exclusively tenanted by the woodland race was Mackenzie's narrative in his "Travels to the Polar Sea," Vol. II, pages 147, 155, 156, 377, where he states that he found them abundant at the headwaters of Peace River. Sir John Richardson, in 1829, made the following statement of the northern range of the bison in his "Fauna Boreali Americana," page 279: "Great Slave Lake, in latitude 60°, was at one time the northern boundary of their range, but of late years, according to the testimony of the natives, they have taken possession of the flat limestone district of Slave Point on the north side of that lake, and have wandered to the vicinity of Great Marten Lake, in latitude 63° or 64°." On page 282 of the same work he thus briefly refers to the woodland

form: "The bison which frequent the woody parts of the country form smaller herds than those which roam over the plains, but are said to be individually of greater size." This is the first published intimation known to the writer of a distinction between the two forms. In Hind's "Narrative of the Canadian Exploring Expeditions," published in 1860, the relations of the wood and plains buffaloes are quite fully considered but no conclusions arrived at, as the author got nearly all his information from hearsay. He says: "Many old hunters with whom I have conversed on this subject, aver that the so-called Wood Buffalo is a distinct species, and although they are not able to offer scientific proofs, yet the difference in size, color, hair and horns are enumerated as the evidence upon which they base their statement. * * * The skin of the so-called Wood Buffalo is much larger than that of the common animal, the hair is very short, mane or hair about the neck, short and soft, and altogether destitute of curl, which is the common feature in the hair or wool of the prairie animal. Two skins of the so-called Wood Buffalo, which I saw at Selkirk Settlement, bore a very close resemblance to the skin of the Lithuanian Bison, judging from the specimens of that species which I have since had an opportunity of seeing in the British Museum. The Wood Buffalo is stated to be very scarce, and only found north of the Saskatchewan and on the flanks of the Rocky Mountains. It never ventures into the open plains."

[redacted]

mountain and woodland animal, should it be proven that such environment was the chosen and constant habitat of this so-called race, would tend to develop just the differences claimed to distinguish them.

In 1885 Mr. E. T. Seton (now Ernest E. Thompson) read a paper on "The Ruminants of the Northwest" before the Canadian Institute, Toronto. An extract from this paper relating to "The Wood Buffalo" was published in 1886 in the Proceedings of the Institute, pages 114 to 117. This paper adds somewhat to our previously published knowledge of the animal in question, but has the same defects which embarrassed the investigations of previous authors, absolute lack of material for comparison. Mr. Seton mentioned that both the Indians and a Mr. E. Mignault, who spent twelve years on the Peace River in the service of the Hudson Bay Co., aver the Wood Buffalo to be a distinct species, keeping entirely aloof from their plains relatives. As proof of this he says that "the last Prairie Buffalo ever seen in the valley was killed in 1866. It was a solitary, mangy bull, a complete outcast, and this need not to have been his condition had the Wood Buffaloes, [of that same region] been his immediate kindred." Mr. Seton seems convinced that his "Wood Buffalo" is a good "variety," but, like all who wrote before him, dares not assign it a distinctive scientific name, calling it "*Bison americanus* var.?" He also advances the theory (and there are many reasons for adopting it) that our plains buffalo is a degenerate, modern offshoot of the ancient woodland stock, which last named species exclusively inhabited the country before the prairies, as such, existed. Parallel instances which he cites in support of this theory are the timber and prairie wolves of the same regions and the timber and barren-ground caribou.

In Chapter X, pages 141 to 159 of his book, "Barren Ground of Northern Canada," Warburton Pike, Esq. describes a hunt for Wood Buffalo in February, 1890, on a tributary of Buffalo River, about 50 miles south of its outlet into the southern waters of Great Slave Lake. This is the first authentic published account, written by an eye witness, of the country exclusively inhabited by the Wood Bison, and the only specific account of a hunt for this race of buffalo by so competent an observer.

Mr. Pike is "inclined to think that the very slight difference in appearance [of the Wood Buffalo] is easily accounted for by climatic influences, variety of food and the better shelter of the woods."

This is all he has to say regarding the main subject of the foregoing discussion. It is quite sufficient, however, to show that he recognized a difference and attributed it to well known laws upon which the systematist bases his limitations of subspecies. His remarks regarding the country and the buffaloes of the region extending from the Liard River and Great Slave Lake to the Peace River, on the east side of the Rocky Mountains, are of great interest. "Scattered over this huge extent of country," he continues, "are still a few bands of buffalo. Sometimes they are heard of at Forts Smith and Vermilion, sometimes at Fort St. John close up to the big mountains on Peace River, and occasionally at Fort Nelson on the south branch of the Liard. It is impossible to say anything about their numbers as the country they inhabit is so large, and the Indians, who are few in number, usually keep to the same hunting ground." Describing the scene of his final hunt, he says: "Prairie and timber were about in equal proportion. * * * About noon we found the track that we had been looking for, easily distinguishable from the many tracks of moose and woodland caribou that we had crossed. Little Francois made a capital approach, and after a couple of hours walk we sighted a band of eight buffalo feeding in a small wood-surrounded swamp."

In the Smithsonian Reports for 1896, pages 407 to 412, Mr. W. [redacted]

is from Peace Point to Salt River, and from Salt River to within twenty miles of Fort Resolution, on Great Slave Lake."

Through the courtesy of Mr. G. B. Grinnell the writer was put in communication with Mr. H. I. Moberly, of the Hudson Bay Co., at Winnipeg, whose personal acquaintance with the woodland and plains buffaloes renders his opinion of much value regarding their so-called distinctions. Mr. Moberly writes as follows in answer to a set of questions on the points in controversy:—

WILLOUGHBY, SASK, N. W. T., November 9, 1897.

S. N. Rhoads, Esq.

DEAR SIR.—I have to acknowledge receipt of your letter dated 29th ult., and will be glad to give you as full particulars as I can regarding the Buffalo:—1st, as to size: They are much larger than the Plains Buffalo. In full-grown animals they are from 100 to 200 lbs. heavier. 2d, relative length of limbs: They are longer limbed and longer in the body than the plains' ones. 3d, length of horn: The horns of the Wood Buffalo are nearly or fully twice the length of the plains' ones, and much straighter. 4th, fur: The long fur [of head, neck and shoulders] is longer and more of a silky fur than the plains' ones, and the under fur thicker and finer pelt, caused, no doubt, by the high latitude they live in. 5th, habitat and habits: They lived formerly from the beginning of the woody country north of the Saskatchewan to Great Slave Lake, and further north along the east slope of the Rocky Mountains. At present there are not more than two hundred and fifty to three hundred alive, and they are in two bands, one on the lower Peace River, north of it, and run from close to Great Slave Lake at Peace Point, which is some ninety miles below Fort Vermilion. The other is on the upper Hay River and ranges between Peace River and the Liard River, and run down some two hundred and fifty miles east of the Rocky Mountains and up to the foot of the Rocky Mountains. I certainly think they are a different animal from the Plains Buffalo. One reason is that formerly, when they were both numerous and met time and again on the edge of the timber line, I have never known any [of one kind] to go with another band [of the other kind]. The Wood Buffaloes live principally on the small branches of birch and willows, although at times they also eat grass. I think there is as much difference between them [wood and plains animals] as there is between the Wood Caribou and the small Barren Ground ones, which [species] meet every winter but never join together. I am

not aware of any specimen of the Wood Buffalo that has been stuffed, but I know that formerly some heads were sent out to Sir George Simpson, who was the Governor of the Hudson's Bay Co.

Hoping this may be of service to you, I remain,

Yours truly,

H. I. MOBERLY.

As previously remarked, Prof. John Macoun has kindly furnished the writer with full data concerning the mounted specimen of Wood Buffalo in the Ottawa Museum, and it is upon this specimen that the following description is based. It was carefully mounted by Ward, of Rochester, New York, in a tightly closed iron and glass case. In consequence, Prof. Macoun was unable to get access to it for more exact measurements.

Bison bison athabascæ subsp. nov. Woodland Bison.

Type:—ad. ♂, in the Geological Museum, Ottawa, Canada. Presented through Warburton Pike, Esq., by the Hudson Bay Company. Secured presumably (fide Prof. J. Macoun) in March, 1892, by Indians within fifty miles southwest of Fort Resolution, Great Slave Lake. Specimen consists of well-mounted skin, with accompanying skull and horn-cores separate, all in one glass and iron case.

Syn. *Bos* or *Bison americanus* (= *Bison bison*) of authors, in part.

"*Bison americanus*, var.?" Seton [Thompson], Proc. Canad.

[redacted]

the line of the base;" nearly semicircular in exterior outline, but more abruptly incurved along terminal third. Horn-cores of detached skull strongly curved, directed at base "slightly downward" below frontal plane, "then outward and upward, the tips slightly incurved, the general direction of core being slightly backward; a line drawn from middle of orbit to tip of core intersecting base of core higher than in *Bison bison*." Horn-cores nearly circular in section at base, becoming slightly flattened above, medially, "with an obscure ridge below."

Measurements.—(Sent by collector with skin to Prof. Frank A. Ward). "Height at shoulders, 1,703 millimeters; height [to rump] just in front of hind legs, 1,602 mm.; total length [of head and body, without tail ?] 2,846 mm."[11]

Skull: (measurements sent by Mr. J. F. Whiteaves, zoologist of Canadian Geological Survey).—Frontal width, between bases of horn-cores, 343 mm.; length of horn-core measured along superior curve, 293 mm.; greatest depression of superior arc of horn-core below a line connecting the tip and superior base of core, 102 mm.; horns (on mounted specimen) measured along the inferior curve, 533 mm.; shortest distance from tip of horn to its superior base, 229 mm.

Habitat.—Wooded uplands of the Northwest Territories, formerly from the east slope of the Rocky Mountains to the 95th meridian, and from latitude 63° to latitude 55°; probably ranging south along the Rocky Mountains to the United States.

Remarks.—The great size, darkness of color, and character of horn and horn-core in the type of *Bison bison athabascæ*, granting that it is typical of the form known as the Wood Bison, are quite sufficient to distinguish it from the plains animal and fully justify the opinions of many hunters and travellers as to its separability from the latter. The characters of the skull alone are sufficient to warrant the distinction. In the type the frontal breadth between the bases of horn-cores is equal to that of the old male specimen of fossil bison (Pl. XII, fig. 2) from California, which Leidy figured as "*B. latifrons*" in the Geological Survey of the Territories; and in this respect is more than 50 mm. wider than the largest old male skull of *B. bison* in the museum of the Academy of Natural Sciences of

[11] Prof. Macoun sends the following measurements from the mounted specimen:—"Height at shoulder, 1,779 mm.; length without the tail, 2,821 mm.; length of horn 458 mm.; circumference of horn at base 318 mm."

Philadelphia. In *athabascæ* the relative length of the horns and horn-cores to the size of the skull is about the same or even greater than in *antiquus*, but on the other hand they are much more slender and recurved than in *B. bison.* In their abrupt curvature they resemble *B. scaphoceras*, but in their relative slenderness they are farthest from that species of any of our American species except the straight and long-horned *latifrons.* Judged solely by horn characters their place in the chronological series would appear to be the latest of all our known species, with the minimum of calibre and the maximum of curvature; but the weight of evidence favors their position between *B. bison* and the most recent fossil species.

Below is given a list of the living and extinct species of American bisons now recognized as valid, with their original references and most important synonyms. The type localities, probable geographic distribution and probable sequence in time are also given. Of the fossil species the following were probably contemporaneous or closely sequent: *B. alleni*, *B. ferox*[12] and *B. scaphoceras* in middle and later Pliocene time; *B. alaskensis*, *B. latifrons* and *B. antiquus* in earlier and middle Pleistocene time; and "*B. latifrons*" (so-called, of Leidy, from California) forming a connecting link in later Pleistocene time with *B. bison* through *B. bison athabascæ.*

1. **Bison alleni** Marsh. Amer. Jour. Sci., 1877, p. 252 (= *B. crampianus* Cope, Jour. Acad. Nat. Sci. Phila., 1895, p. 456).

Lower Pliocene of Kansas. Great Plains of Middle North America.

[redacted]

6. Bison antiquus Leidy. Proc. Acad. Nat. Sci. Phila., 1852, p. 117, (= *B. crassicornis* Richardson, Zool. Voy. Herald, 1854 [restricted type], pp. 40 & 41, Pl. IX).

Pleistocene of eastern Kentucky. North America, from northwestern Alaska to southeastern Georgia and Texas.

7. Bison ———— sp. ?[13] (="*B. latifrons*" Leidy, Rep. U. S. Geol. Surv. Terr., I, p. 253, Pl. XXVIII, figs. 4 & 5).

Pleistocene of western California. Pacific slope, from Oregon southward.

8. Bison bison athabascæ subspec. nova (l. c.), (= *B. bison* Auct. in part.=" Wood or Mountain Buffalo").

Recent of northern Athabasca, N. W. T. Wooded uplands of the Northwest Territories, from the east slope of the Rocky Mountains to the 95th meridian, and from lat. 63° to lat. 55°; probably reaching southward along the Rocky Mountains to the United States.

9. Bison bison (Linnæus). Syst. Nat., 1758, p. 72; (= *B. americanus* Gmelin, Syst. Nat. Linn. I, 1788, p. 204).

Recent of Interior North America. Lowlands east of the Rocky Mountains and west of the Allegheny Mountains, the Great Lakes and Lake Winnipeg; and from the Saskatchewan River south to the Gulf of Mexico, near lat. 25°.

EXPLANATION OF PLATE XII.

Fig. 1. *Bison bison* (L.). Old male; Col. of Acad. Nat. Sci., Phila., No. 4,589; from the plains of the western United States.

Fig. 2. *Bison californicus* sp. nov. type. Old male; Col. Acad. Nat. Sci., Phila., No. 297; from Pilarcitos Valley, near San Francisco, California. Labelled "*Bison antiquus* Leidy." The original of Leidy's figures of "*Bison latifrons*" (sic), U. S. Geol. Surv. Terr., Vol. I, 1873, p. 253, Pl. XVIII, figs. 4 & 5.

Fig. 3. *Bison alaskensis* sp. nov. type. Old male; Col. of Mus. Sci. and Art, Univ. of Penna., No. 13,754; from Tundra, near Point Barrow, Alaska.

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[13] During the foregoing investigations the writer was in frequent correspondence with Mr. F. A. Lucas, of the Smithsonian Institution, who is preparing an illustrated monograph of American fossil bisons, and has kindly given valued suggestions on controverted points. Having called his attention to the radical differences between the type of Leidy's *B. antiquus* and his California specimen of so-called "*latifrons*," Mr. Lucas now concurs in the opinion that they are distinct species, and that the California species should be given a name. It is therefore proposed that the name *Bison californicus* be applied to it, the type of the species being No. 297, Col. Acad. Nat. Sci., Phila. For characters, etc., see Leidy references; also Pl. XII, fig. 2.

Fig. 4. *Bison latifrons* (Harlan), type. Col. of Acad. Nat. Sci., Phila. From Big Bone Lick, Kentucky.

Fig. 5. *Bison crampianus* (Cope), type. Col. of Acad. Nat. Sci., Phila., No. 3 ; from Wellington, Kansas.

Fig. 6. *Bison alaskensis* sp. nov., type. Rear view of specimen, No. 13,754 figured under No. 3, of same plate.

NOTE.—Figures 1 to 5 inclusive were photographed on same plate and as nearly at same facial angle as possible, to show their comparative size and the curvature of horn-cores. Figure 6 was photographed separately and on a larger scale, as will be noted on comparison with figure 3 of the same specimen.

DESCRIPTIONS OF TWO NEW FORMS OF PERIDERIS.

BY HENRY A. PILSBRY.

Perideris Kobelti n. sp.

Shell ovate, ventricose, whitish under an olivaceous yellow cuticle, brownish in places. Surface obliquely plicatulate in the direction of growth lines, and above the periphery decussated by numerous rather inconspicuous spiral impressed lines. Spire abruptly contracted above, mucronate. Whorls about 6½, the earlier 2½ forming a mamillar projection, the rest rapidly widening, last whorl swollen. Suture white from loss of cuticle, and minutely beaded. Aperture oblique, reddish inside; lip obtuse, brown; columella whitish, vertical rather straight, subtruncate below. Alt. 65, diam. 40, alt. of aperture 35 mm.

Cape Palmas, West Africa. Type in coll. A. N. S. P.

This species is evidently identical with Kobelt's *P. saulcydi* (Conchyl. Cab., p. 42, pl. 13, f. 1, 2). It is far from being the species so called by Joannis. It is likely that Kobelt had not seen Joannis' original description and figure, from the fact that his reference to that author is altogether incorrect; and thus the misidentification arose.

Perideris Saulcydi var. **normalis** n. var.

Shell resembling *Achatina Saulcydi* Joannis (Magazin de Zoologie, 1834, Classe V, pl. 50) in the general coloration, being white streaked with livid purple, with some bluish suffusion, the penultimate whorl whitish with reddish flames. Whorls about 7½, the earlier 3 forming a mamillar mucro, higher and more distinctly differentiated than in *Saulcydi*, those following forming a more tapering cone than in *Saulcydi*, the last not perceptibly constricted below the suture. Suture margined below by a narrow crenate or beaded band. Sculpture: unequally, obliquely plicatulate, sometimes with subobsolete spirals on penultimate whorl, the last whorl with faint, obliquely descending, scar-like impressions at right angles to the growth-lines. Aperture oblique, dark purplish-brown inside; parietal wall orange-brown from the retention of the cuticle by the parie-

tal glaze. Columella somewhat concave, passing gradually into the thin basal lip.

Alt. 76, diam. 40, alt. of aperture, 36 mm.

Alt. 74, diam. 40, alt. of aperture, 35 mm.

"Taboo, Africa" (Robert Swift coll. in A. N. S. Phila.).

This form differs from *P. Saulcydi* (Joannis) in being more elongated and slender throughout, the last whorl not concave above, aperture consequently not acuminate posteriorly as in that species; the spire more elongated and tapering, and the terminal "*mamelon*" more pronounced.

It is also dextral; but as the apparent sinistrality of Joannis' species may possibly (though not probably) be due to an artist's failure to reverse, I do not place great stress upon this feature.

Illustrations of this and the preceding form will appear in the *Manual of Conchology* in due time.

PROCEEDINGS OF A MEETING HELD IN COMMEMORATION OF HARRISON ALLEN, M. D., AND GEORGE HENRY HORN, M. D.

In compliance with a resolution adopted by the Academy of Natural Sciences of Philadelphia a meeting was held December 31, 1897, in conjunction with kindred societies, to commemorate the services rendered to science by Dr. Harrison Allen and Dr. George H. Horn. The Chair having been taken by Dr. Henry Skinner, Chairman of the Committee of Arrangements, the following papers were read:—

BIOGRAPHICAL NOTICES OF HARRISON ALLEN AND GEORGE HENRY HORN.

BY EDWARD J. NOLAN, M. D.

The period of the Academy's history with which Doctors Allen and Horn are first identified, the years of the early '60's, was bright with both accomplishment and promise. Made notable by the work of the illustrious veterans who were still active and by that which might be hoped for from those who were just beginning their careers, it was probably the most brilliant epoch in the history of the society. But few of the great collections which have since come into prominence were in existence. The Smithsonian Institution was then rather a distributing agency than a store-house of scientific material, and museums everywhere were benefited by its activity. The United States Government had not become, through the Agricultural Department, the National Museum, and the Geological Surveys, a formidable rival in the publication of scientific papers, and the work of Gill, Meek, Hayden, Coues, Stimpson, Kennicott, Yarrow and others was made known to the scientific world most promptly and accurately through the *Proceedings* of this Academy.

In the old building at the corner of Broad and Sansom Streets, Leidy, easily first among equals, pursued his paleontological studies in a little, dark and dusty room on the first floor of the museum, his brilliant microscopical investigations being carried on more comfortably at home. The results were reported in either case to the meetings of the Academy, and could generally be depended on to render them interesting, even though nothing else were forthcoming.

Cassin had the western room of the library filled with trays of mounted birds and scores of ornithological volumes which no one about the place dared to touch, for Cassin was very much of an autocrat and was impatient of rules. Books and specimens, however, were made good use of, especially on Sundays, for the exigencies of bread-winning left him but little time during the week for his favorite study.

S. B. Buckley occupied the herbarium, a long, narrow, dark room in the southeast corner of the second museum floor. He had presented and published some interesting observations on ant-life, and was then working up his collection of Texan plants, the publication of his results calling forth savage criticism from Asa Gray, which created quite a stir at the time and gave poor Elias Durand, the Director of the Herbarium, more than one bad quarter of an hour.

The President, Isaac Lea, was reading by title his contributions to the genus Unio and other conchological papers, synopses of which were published in the *Proceedings*, to be afterward expanded into parts of the *Journal*, sumptuously illustrated at the expense of the author by some of the finest lithographs ever made in America.

The place left vacant in 1850 by Samuel George Morton had been filled by James Aitken Meigs, who, after serving a brief term as Librarian, was devoting all the time he could spare from a rapidly growing practice to the study of anthropology. Thirty years later

[redacted]

collections, a disadvantage which, in November, 1865, resulted in the appointment of a committee "to devise," in the language of the resolution, "methods for advancing the prosperity and efficiency of the Academy by the erection of a building of a size suitable to contain the collections."

In the intervals of cruises, Dr. Ruschenberger was introducing improvements in the administration of affairs, and to his energy and devotion is due the ultimate success of the Committee on Building then appointed. Some administrative reforms were indeed required, for although the Academy had been brought to the distinguished position it then held by the voluntary labors of those interested in the advancement of knowledge, the absence of responsibility was productive of serious disadvantages. Up to this time no one connected with the institution, except the janitor, had received continuous compensation for service rendered, although appropriations were made from time to time for special work as occasion required. The services of an Assistant Librarian were secured in January, 1862, at the munificent compensation of two dollars a week, and an assistant to the Curators was appointed some time after. Dr. Leidy, then, as during the rest of his life, Chairman of the Curators, had been heard to declare that if the Academy were in possession of everything it had ever owned, a building twice the size of the one then occupied would be required to house the collections. The losses were due partly to the destructive action of time, partly to bad museum methods, and partly, it is to be feared, to a liberal interpretation of the law of *meum* and *tuum*. The enthusiastic young naturalists of the period were allowed to rearrange and disarrange the collections as they pleased, each according to his own ideas of classification. Infested birds were carried to the cellar by the hundred and baked in a hot oven until they became as brittle as punk. The insects, especially, were entirely neglected because of the activity of the recently founded American Entomological Society and the serious disagreement then existing between Thomas B. Wilson and John L. LeConte. A valuable collection of insects was being rapidly reduced to dust, and an enthusiastic young entomologist of the time proposed transferring the few remaining good butterflies bodily to his own collection, so that they might be preserved from destruction. It was not the Curators or the members of the Entomological Committee, but the Assistant Librarian who prevented the carrying out of his virtuous intention. As for the

library: a distinguished ornithologist has recently been heard to lament that in Cassin's time he could take away any book he wanted. The by-law governing the case then, as now, forbade the removal of books from the building, and, although this gentleman doubtless returned all he borrowed, the same, it is to be feared, could not be said of others who violated the law. Although then without a cent of endowment, this department of the Academy was kept well up with the times by exchange of publications and the munificence of Dr. Thomas B. Wilson.

The meetings were interesting and well attended, and the annual volume of the *Proceedings*, thanks to the absence of competition, had attained dimensions not since reached.

The most hopeful feature, however, of that epoch, was the galaxy of young men who were then appearing on the scene, some of whom turned out to be brilliantly successful, while others were far from reaching the goal of their ambition.

Cope had been elected a member in July, 1861, although prior to that he had been an active worker in the Academy. The Curators had reported in 1859: "The care of the herpetological cabinet, which for some time had lost the valuable services of Dr. Hallowell in consequence of illness, has now been undertaken by E. D. Cope, a young man who gives promise of much future usefulness both to the Academy and to Natural History." He contributed three [redacted]

Tryon's first paper had been contributed in 1861. He was an indefatigable worker, and gave up his interest in a lucrative business to devote himself to science. He was most generous in his appreciation and encouragement of others. He started the *American Journal of Conchology* in 1865, and, in 1879, the *Manual of Conchology*, which is still issued by the Section founded by him. His business training and strict attention to details of management enabled him, strange to say, to make both of these unpromising enterprises yield him a revenue, all of which, with much more, was, on his death, left to his favorite department of the Academy. In quite a special sense, therefore, his work continues.

Gabb had been appointed a Jessup Fund student, and was engaged in those studies which enabled him to render good service on the Geological Survey of California, and to act as Director of the Survey of San Domingo. The income of the Jessup Fund had become available for the assistance of young naturalists in 1860, the first recipient of benefits being Charles Conrad Abbott, then engaged in the study of ichthyology, but since celebrated for his graceful contributions to the literature of popular natural history. During the first years of the existence of the Fund, nearly all the young workers in the Academy, including the subjects of this notice, and several of more mature years, were assisted from the income thereof. The Jessup Fund was then, and continues to be, productive of most desirable results.

Prominent in this group of aspiring young naturalists were Harrison Allen and George Henry Horn. It is especially fitting, and, indeed, almost unavoidable, that the services rendered by them to science should be commemorated jointly, as their lives were laid in parallel lines to a singular degree. Horn was born in 1840, Allen one year later; they were pupils of the Central High School at the same time, classmates and members of the same graduating class in the Medical Department of the University of Pennsylvania; their work in the Academy began about the same time, they were both Jessup Fund students, they served contemporaneously in the medical corps of the army during the closing years of the war; they were to a limited degree, collaborators in their scientific work; they each held the office of Corresponding Secretary in the Academy, they were members of the Academy's Standing Committees at the same time; they sat together at the Council Board until their work was done, and they died within ten days of each other—the elder after a

trying period of incapacity, the other in the full enjoyment, to the last, of those scientific pursuits which had rendered his entire life tranquil and happy.

HARRISON ALLEN was born in Philadelphia, April 17, 1841. He was admitted to the Central High School in February, 1855, from the Hancock Boys' Grammar School. He then resided at No. 352 N. 6th St. In consequence of straitened means, he was compelled to leave the High School in March of the following year for a position in a hardware store, where, however, the conditions were so uncongenial that he remained but a short time. A subsequent experiment proved that life on a farm was quite as foreign to his inclinations as the commercial engagement.

Impelled by his innate love of science, and taking advantage of the only avenue at first open to him in the desired direction, he then entered the dental office of Dr. J. Foster Flagg and there pursued his studies with such earnestness and fidelity as to secure for himself the warm and enduring regard of his preceptor. His dental studies were, however, merely the introduction to his life work. He did not matriculate at the Dental College, and that he had no intention of doing so is evident from a letter which the youth wrote to his mother in 1860, during his course in medicine. An extract is of special interest because of the definite aims and ambitions defined [redacted]

Short as had been his time in the High School, there is little doubt that his love of natural history resulted from the influence exerted by Dr. Henry McMurtrie, who then filled the chair devoted to that subject. At least one collecting expedition in company with Horn and two or three other school-mates was referred to many years later by Dr. Allen as the occasion of lasting delight, and the fact that he named the Mexican bat which formed the subject of his second paper *Centurio McMurtrii*, after his old teacher, proves that he held him in deservedly kind remembrance. The immediate cause, however, of the first publication was probably the interest taken in the collections of Paul B. DuChaillu, which had just been secured by subscription for the Academy.

Dr. Allen was elected a member of the Academy in 1862, his proposers being Messrs. Cassin, Cope and Cleborne. He had, however, very little time for natural history. After serving a year as resident physician in the Philadelphia Hospital, he was commissioned as Acting Assistant Surgeon in the United States Army, January 31, 1862, and for the next four years was actively engaged professionally in the field or in military hospitals. His first assignment was to the Broad Street General Hospital, Philadelphia, from which he was transferred, May 17th, to Cliffburne General Hospital, Washington, D. C. He was given the rank of Assistant Surgeon, July 30th of the same year, and until the February following was in the field with the artillery of the 3d Corps in the Army of the Potomac. He then served in the Douglas, the Lincoln and the Carver Hospitals of Washington, the Fairfax Seminary Hospital of Alexandria, Virginia, and, from December, 1864, until September, 1865, he was in responsible charge, at the age of twenty-four years, of the Mt. Pleasant General Hospital in Washington. From September 12th to October 12th, 1865, he enjoyed a well-deserved leave of absence. On his return to duty he was again assigned to the Douglas General Hospital, where he remained until December 1st. A week later he resigned from the army with the rank of Brevet-Major. During his period of duty in Washington he spent much of his leisure time in the Smithsonian Institution where he was brought under the influence of Professors Joseph Henry and Spencer F. Baird, men to whom so many of the naturalists of that period were indebted for inspiration and encouragement.

Of these months his friend and associate Dr. Theodore Gill writes: "While he was in charge of the Fairfax Seminary Hospital I visited

him several times and stayed some days each visit. He used to bring or send an ambulance for me, and I remember the pleasure I had in the country, going there. I was much struck with the administrative ability he displayed. Remember that he was a very young man for such a place as he held, having a considerable staff of assistants, all of whom, I think, were older than himself. He was a rigid disciplinarian, and I heard he was complained of for keeping aloof from his staff, but I am inclined to think he was wise in doing so. He did not join with the hospital surgeons' mess, but had his meals served in a pleasant room, taking them alone or with members of his staff or others whom he specially invited for each occasion. His companionship was certainly very congenial to me, and I presume, from the frequency and urgency of his invitations, mine was to him. Our discussions were by no means confined to medicine or even zoology. They embraced a wide range of subjects, and I was often surprised to learn how multifarious were his sympathies and how wide his range of reading."

On his return to Philadelphia he made an earnest but dignified canvass for the Professorship of Zoology and Comparative Anatomy in the Auxiliary Faculty of Medicine of the University, just then endowed by Dr. George B. Wood. He was endorsed by strong letters from American and foreign naturalists who recognized the merit of his published works. He had no social backing; the influ-

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appointed to fill the vacancy. He held the professorship until 1885, when he resigned because of increased professional work. He was emeritus professor of the Institutes until 1891, when, on the death of Dr. Leidy, he resumed his old position in the Auxiliary Faculty which he held until last year. He also served for one year as Director of the Wistar Museum.

On establishing himself in Philadelphia at the close of the war, he at first engaged in the practice of general surgery. His love of minute detail caused him to concentrate his attention on the affections of the upper air passages, his inclination to do so being, perhaps, obscurely the result of his early dental studies. So successful was he in his specialty that he soon became a recognized authority in laryngology and rhynology, the latter science having, it may almost be said, originated in his diagnosis of disturbances of the nasal mucous membranes and his careful descriptions of departures from the normal anatomy of the facial region.

His professional and zoological work were equally distinguished by untiring care in the elaboration of minute details, a characteristic as evident in his first descriptions of bats as in his most recent craniological studies. Had Dr. Allen been an artist instead of a physician he would have been a Meissonier rather than a Makart.

The scope of Dr. Allen's interest in professional and scientific work is clearly indicated by the positions he held in the Academy and elsewhere, a brief statement of which is all that can be here given:—

He was assistant to Wills' Eye Hospital from 1868 to 1870; Surgeon to St. Joseph's Hospital from 1870 to 1878 and visiting surgeon to the Philadelphia Hospital from 1874 to 1878.

He held the position of Professor of Anatomy in the Philadelphia Dental College from 1866 to 1878. He was Vice-President of the Pathological Society of Philadelphia in 1877; President of the American Laryngological Association in 1886, of the American Association of Anatomists from 1891 to 1893, and of the Anthropometric Society at the time of his death. He served as judge in the Section of Anthropology at the Columbian Exposition in 1893, and was a member of the American Philosophical Society, the Boston Society of Natural History, the Biological Society of Washington, the Philadelphia County Medical Society, the Neurological Society of Philadelphia, the Historical Society of Texas, and Corresponding Member of the Society of Natural Sciences of Chili. He served as President of the Contemporary Club in 1894–1895.

It was in connection with the Academy, however, that nearly all of his extra professional work was accomplished. He was but little interested in administrative affairs, and was reluctant to accept official positions the duties of which might interfere with his favorite studies. He served as Corresponding Secretary in 1867, and was a member of the Council at intervals from 1876 until his death. He also served on the Library Committee. He was instrumental in founding the Anthropological Section and was its Director until his death. He contributed his last scientific communication to one of its meetings. The character and extent of the work accomplished in the Academy and elsewhere will be considered by competent judges of its value.

Dr. Allen was married to Miss Julia Colton, Dec. 29, 1869. His widow, a son and a daughter survive him. He found rest and relaxation from his professional and scientific work in literature, music, and the sympathy and affection of a devoted domestic circle. His summers were spent at his home in Sciasconset on Nantucket Island, whence he would return in the fall invigorated by the outdoor life of a lover of nature.

In his intercourse with his professional brethern and his scientific associates, Dr. Allen was always helpful and appreciative. A certain reserve and dignity of bearing gave assurance of intellectual force which was fully realized on a close acquaintance with the man and his work. He was precise and careful in his statements, charitable [redacted]

will be published by the Wagner Free Institute of Science and the United States Government.

He presided at the meeting held November 12th in commemoration of his life-long friend the late Edward D. Cope, in the rooms of the American Philosophical Society. Some of those who were present on that occasion were painfully aware that Dr. Allen was far from well. Two days later, on the afternoon of Sunday, November 14th, he was seized with an attack of angina pectoris which resulted in death.

In 1860 he had written to his mother: "it is my ambition to be known as a good physician and a good man." Those who knew Dr. Allen best as a physician and a man, know with what completeness of fulfilment he had lived his life.

George Henry Horn was born in Philadelphia, April 8, 1840. His preliminary education was received in the Jefferson Boys' Grammar School, from which he entered the Central High School, July, 1853. He took the full course and graduated with the degree of Bachelor of Arts, February 11, 1858. The degree of Master of Arts was conferred on him by his Alma Mater, July, 1863. At the time of his graduation he lived at the southwest corner of 4th and Poplar Streets, where his father was the proprietor of a drug store.

Almost immediately after leaving the High School he matriculated in the Medical Department of the University of Pennsylvania. He took his degree in medicine in 1861, his thesis being entitled "Sprains."

While yet a student of medicine he contributed his first papers to the *Proceedings* of the Academy. He did not immediately devote himself to the specialty in which he later became so distinguished, his first three contributions to science being descriptions of new species of recent and fossil corals and comments on Milne-Edwards' classification of those organisms.

There is every reason to believe that his incentive to the study of natural history was received, as in Dr. Allen's case, from the professors of the High School. In addition to McMurtie's lectures, Dr. B. Howard Rand, at that time Recording Secretary of the Academy, was liberal in the distribution of tickets of admission to the Museum, and many of his pupils found profitable occupation for their Friday afternoons in visiting the collections.

Horn was early thrown into association with Dr. John L. Le-Conte, whose prominence as a coleopterologist was undisputed. The mutual regard then established led to community of study and was only interrupted by death.

Dr. Horn's fourth paper, also published in 1860, was on new species of North American coleoptera in the cabinet of the American Entomological Society. His later contributions to science, the extent and value of which will be treated of by one eminently qualified to do so, were, with one or two exceptions, devoted to this specialty, as an authority on which Dr. Horn certainly had on rival in America at the time of his death.

Having passed the required examination, Dr. Horn received a commission as Assistant Surgeon in the United States Army, March 1, 1863. He was attached to the 2d California Cavalry, Department of the Pacific, until July 14th of the following year, when he was commissioned as surgeon of the 1st California Infantry Volunteers, remaining in that position until the term of service of the regiment expired, Dec. 3, 1864. He was again mustered into service May 22, 1865, as assistant surgeon of his old regiment, the 2d California Cavalry, and commissioned as surgeon of the 2d California Infantry, September 23, 1865. His service terminated with that of the staff of his regiment, April 16, 1866.

During his military service in the west he improved the opportunity to make extensive additions to his collection of coleoptera, [redacted]

married, he was not distracted by domestic ties from his favorite occupation, and for social engagements he cared but little. Art and literature were to him outside issues, very well in their way, but to be left to the cultivation of others. As a contributor to knowledge, his function was well-defined, and recognition of his success as an entomologist was valued by him the more because of the singleness of his interest.

It is gratifying to know that such recognition was conveyed to him in abundant measure by those who knew of the enduringly accurate character of his work. He was one of the twelve honorary members of the Entomological Society of Belgium, one of the sixteen honorary members of the Entomological Union of Stettin, and one of the eleven honorary members of the Entomological Society of France. He was an active member of the Russian Entomological Society, Correspondent of the Boston Society of Natural History, the Biological Society of Washington, the Kansas Academy of Sciences, and the Zoologico-Botanical Society of Vienna. He was also a member of the College of Physicians of Philadelphia, the Entomological Societies of New York, Washington and Newark, and honorary member of the Feldman Collecting Social. He was Librarian and one of the Secretaries of the American Philosophical Society at the time of his death.

On the death of his valued friend, Dr. John L. LeConte, he was elected President of the American Entomological Society, a position which he held continuously until his death, combining with it the Directorship of the Entomological Section of the Academy.

He received the title of Professor of Entomology from the University of Pennsylvania. The position, it is believed, was entirely honorary, no active duties being attached to it.

As might be supposed from the strictly defined limits of his field of scientific investigation, his work was more in connection with the American Entomological Society than with the Academy, although his interest in the latter was unflagging. He was elected a member July 31, 1866, on his return from the west. He served as Corresponding Secretary from 1876 to 1890. He was a member of the Council from February 23, 1875 to December 26, 1876. He was again elected in December, 1891, and held the position at the time of his death. He also served on the Finance Committee for 1893, and on the Publication Committee from 1875 to 1890, and from 1893 to the end. The duties of these several positions were performed by him with fidelity and discretion.

His relinquishment of active professional work was probably due to a consciousness of failing vigor, but the gravity of his condition was not manifest until December 26, 1896, when he was stricken with unconsciousness while engaged in playing a game of cards with some friends at the Columbia Club. Although he partially rallied from the attack and was able to attend the Nansen meeting in the rooms of the American Philosophical Society, his work was done and the interval was one of patient waiting for the end. Among his few relaxations during his later years, had been those enjoyed as a member of a fishing club which occupied a comfortable house at Beesley's Point, N. J. He took an active part in the management of the establishment, and the last months of his life were spent there, until a renewed attack of cerebral hemorrhage terminated in death, November 24th of the present year.

The loss sustained by the Academy in the death of Drs. Horn and Allen is the most recent of a disastrous series beginning in 1891 with that of Dr. Joseph Leidy, and immediately preceded early in the present year by that of the brilliant naturalist, Edward D. Cope. The effect of such subtraction from the membership of the society must be acutely felt, but the work of these distinguished men lives after them, and we may be consoled by the hope that the influences which formed them, and which in no small measure emanated from this Academy, may continue to produce worthy [redacted]

nature of brief contributions to four of the more important American scientific journals and cover from one to four pages each. In many cases they were simply elaborations of verbal announcements first made at the meetings of this Academy. His monographic work comes under four titles, and it is worthy of special note that of the seventy titles appearing under his name, thirty-five relate almost exclusively to the Chiroptera or bats.

Dr. Allen's systematic work was confined wholly to the bats, a fact the more remarkable in view of his wide knowledge of and interest in many other families of the Mammalia. It is significant of his very early interest in this difficult and neglected group of animals, that his first published paper was printed in the *Proceedings* of the Academy in 1861 under the title, *Descriptions of New Pteropine Bats from Africa.* He here describes a new genus and three new species of African bats in the collections made by Du Chaillu and presented by subscription to the Academy. As a first effort this paper is surprisingly well prepared, both from the systematic and the anatomical points of view. Even granting his anatomical knowledge as a graduate of medicine, it is difficult to believe that the author had not made a close study of the bats previous to inspecting the Du Chaillu novelties. The theory that his interest in the Du Chaillu collections, coupled with the opportunity of entering upon a comparatively unworked field of original research, was the incentive of his life-long devotion to study of the Chiroptera, is probably correct.

Only three short papers by him, all on the Chiroptera, appeared between 1861 and 1864, during his service in the United States Army. It was in Washington while thus engaged that he came under the inspiring influence of Prof. S. F. Baird, to which was probably due the issue, in 1864, of his first *Monograph of the Bats of North America.*

Professor Baird having wholly omitted the Chiroptera from his great work on North American mammals, published by the Government in 1857, Dr. Allen was now able to supply a long felt need in the zoological literature of America. Confined as it was to a technical treatment of the species found north of Mexico, the monograph was limited to eighty-five pages of a volume of the *Smithsonian Miscellaneous Collections.* Of the twenty species and eight genera recognized, one genus and six species were first described by the author.

In forming an estimate of this work it would be unfair to test it by later standards. We must allow much for the crude conceptions and scant knowledge of American bats then existing among the most distinguished naturalists. The number of specimens then available for study in our museums was but a tithe of those now existing, and in the light of such facts Dr. Allen's initial work, performed during his leisure hours, does him credit as the pioneer in this branch of mammalogy.

In 1893 his second *Monograph of the North American Bats* appeared as *Bulletin No. 43* of the National Museum. This issue, more than twice the size of its predecessor, is based on more extensive suites of specimens than the first and summarizes the investigations of himself and others, including Dobson, during the intervening thirty years. The book is well illustrated, new methods of anatomical comparison are introduced and the morphology in many cases is greatly elaborated. The results, from the standpoint of the systematist, are somewhat confusing, and it is evident that the author was at times led astray by a wrong conception of the laws of geographic variation and unduly biased by his theory of pedomorphism. His effort to set his nomenclature on an enduring basis is only partially successful, handicapped as he was by his association with old-school systematists and the small amount of leisure which active office practice allowed him for an exhaustive examination of the literature. As a compendium of our knowledge

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classed those relating to animal locomotion. In 1869 appeared his *Outlines of Comparative Anatomy and Medical Zoology,* a compend of his lectures delivered in the University of Pennsylvania as Professor of the branches treated of. The concise character of this little book, its simplicity of classification and treatment, and its suggestiveness to the student in original research, distinguish it from ordinary text books, and it may still serve as a valuable guide to instructors in anatomy.

Notes on the *Conformation of the Mammalian Skull* and *Studies in the Facial Region,* also record observations indicating the special studies which Dr. Allen had been conducting previous to the year 1875 and which were bringing him into prominence as an anatomist.

In his studies of animal locomotion Dr. Allen deserves special notice, standing as he does quite alone in his discussion of Prof. Muybridge's instantaneous photography of animals in motion. This work was performed at the request of the University of Pennsylvania. He had previously studied anatomically the limbs of the mammalia, notably the wings of bats, with a similiar purpose in view. His paper was modestly entitled *Materials for a Memoir on Animal Locomotion.* On this unpretentious basis the whole essay is largely conducted, no theories or generalizations being indulged in where a more imaginative writer would have felt at liberty to roam at will. He confined his speculations on animal locomotion, as in his previous work, chiefly to practical suggestions for future investigation.

In connection with this work we find several examples of newly-coined words and technical terms called for by Dr. Allen's studies in minute anatomy. Without such additions to nomenclature a new branch of technical study such as the one undertaken by Muybridge and Allen could not be intelligently, and at the same time concisely, presented.

In 1884 Dr. Allen published his *System of Human Anatomy,* a quarto volume of eight hundred pages, profusely illustrated, and representing an amount of learning and labor far out of proportion to its popularity and financial success.

His *Distribution of Color Marks in the Mammalia* which appeared in the *Proceedings* of the Academy in 1888, is the most important contribution to the literature of the subject yet published by an American author. He states his "main object has been to contemplate color marks as the result of nutritive processes, controlled by recognized biological forces both in health and disease." The paper is a

valuable record of observations made on the lines defined by previous writers, especially by Eschricht and Voigt, on the human subject. It forms a valuable summary of previous work, adding much material for future research, but advancing no hypotheses. In this the author was consistent with the cautious conservatism which characterized his life.

Taking a comprehensive view of the zoological work of Dr. Allen in connection with our knowledge of his personality, we are most impressed with its conscientiousness united to an unselfishness only too rare among men of Science.

In a personal acquaintance with Dr. Allen as a student of zoology, the author was early impressed with his serious and deliberate, almost solemn, consideration of the subject in hand. A more intimate acquaintance revealed his geniality and humor and his philosophic interest in created things.

He never reached conclusions hastily even on subjects of minor import. His faculty, may it not be said his genius, for tentative suggestion as to the significance of phenomena was exercised in such a conservative way that it could neither mislead nor be misconstrued as a declaration of belief. His sincerity of purpose, his humility, and his love of nature endeared him to his associates and emphasize their regret for his loss.

of somatology or anthropologic anatomy. His contributions to this latter branch it will be my effort to sketch.

Its special aim is to set forth clearly and to estimate justly the anatomical difference which we find, on the one hand, between races or varieties of the human species, and on the other, between this species itself and those below it in the scale of organized beings.

It is, in the fullest sense of the word, *morphology:* the study of forms and their fluctuations under the influences of environment, nutrition, correlation, heredity and pathological processes, the endeavor always being to trace the given form to its etiological factors. Thus its methods are those of inductive science in the truest sense. Yes, they go beyond this; they lead up, in their highest expression, to laws and formulas which are cosmic in application, and express the universals of knowledge.

This was fully recognized by Dr. Allen, and he gave it expression in the memorable phase, "Morphology embraces all animated structures as parts in a scheme of Philosophy."

I wish to emphasize this dictum, because all his work in the somatic field of anthropology was dominated by, and must be read in the light of, this wide conception of its meaning.

No greater mistake could there be than to imagine that this recognition of the indefinite value of observations led him to seek premature generalization or to neglect minuteness of details. The opposite is true. and it were hard to find an example of a more painstaking, laborious student of the smallest features of individual and racial anatomy.

I could not bring to your knowledge a more striking example of this than one of his earliest contributions to anthropologic anatomy, one published more than thirty years ago in the *Dental Cosmos* for November, 1867.

Its subject is *The Jaw of Moulin-Quignon,* a title which will probably not be very full of meaning to many of you, so I must premise by explaining it.

When the celebrated French antiquary, Boucher de Perthes, made his discovery of hand-made stone implements in the preglacial gravels of Abbeville, it was objected to him that no human bones had been found among those of the elephants and hippopotami in the strata. He saw the force of this objection and offered a handsome sum to any of the quarrymen who should make such a discovery. It is not surprising that in a short time such a human

relic was found, the half of a lower jaw, imbedded in the gravel about fifteen feet below the surface. He announced it with glee, but the jaw met with such an equivocal reception that a mixed English and French commission of expert geologists, archæologists and anatomists, was appointed to repair to Abbeville and settle the discussion. The result could have been predicted. The committee convened, talked, inspected the gravel pit and went away, each member being more than ever convinced that his former view was correct.

This took place in 1863, and for several years there continued a lively debate as to the authenticity of the find, eminent scientists arraying themselves on each side.

Without referring to other points in the controversy, I shall mention only that which attracted Dr. Allen—the anatomical peculiarities of the bone. It was argued by those who believed the find to be genuine, that the characteristics of this lower jaw were so marked that it must have belonged to a race of men widely divergent from the present inhabitants of France. It was to this special question that Dr. Allen addressed himself. He divided it into two headings, as follows:

1. What is the pattern of an ordinary jaw?

2. What is the value of the lower jaw in Man, as a test character of race?

You will form some idea of the amount of labor which the author bestowed on this paper when I add that in its preparation he visited

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omy. He was never satisfied with describing variations merely. To his acute and orderly mind they remained valueless and meaningless until their full significance, both as cause and consequence in the complete morphology of the individual, was set forth.

This masterly grasp of the inter-relation of anatomical facts was finely illustrated by his various communications in the *Proceedings* of this Academy and elsewhere, on the consequences brought about when the immediate ancestor of Man gradually adapted himself to walk upright instead of upon "all fours."

Dr. Allen traced most of the special anatomical characteristics of Man to this evolution from a quadrupedal to a bipedal type. He pointed out how it led to a new disposition or re-arrangement of the special organs, such as pushing the heart over to the left side due to the flattening of the sternum, and changes in the position of the teeth. He took pains to point out also that our species is still far from being entirely adapted for the erect position, as is evidenced by the inadequate valvular mechanism of the veins, the shape of the pelvis and other features.

Such considerations led him in one of his later papers, read before the Congress of American Physicians and Surgeons, (1894), to point out the practical application of morphology as a factor in the etiology of disease. This essay is full of interesting matter for the anthropologist, and is largely based on comparative racial anatomy.

He justly says: "The scientific study of race in connection with diseased action is almost an unbroken field."

I have space to mention only two of the highly important conclusions reached in that essay.

The first is the striking distinction which he draws between specialization and degeneration in Man, as compared with analogous processes in the lower animals. I illustrate it by his example of the change from a quadritubercular to a tritubercular tooth in the human species. Dr. Allen remarks of this: "We can say with certainty that the loss of a cusp in a human molar tooth is associated with decreased initial energy; and that such changes are not due, as in the lower animals, to adaptation to special, and as a rule to higher ends."

The second point in this paper of the greatest interest to anthropologists, is the contrast which Dr. Allen draws between the skeletons of civilized and uncivilized men. The bones of civilized peo-

ples are marked by an absence of correlation, or, to use his own expression, "The bones themselves appear to become individualized."

This presents a curious analogy to the sociological results of civilization, for it is generally acknowledged that the highest product of culture is the development of the individual life, and the specialization of mental activities.

Dr. Burt J. Wilder, in commenting on this address, remarked that the fundamental thesis of the author appeared to be that *structure is a record of function.* Though Dr. Allen did not directly accept this rendition of his philosophy, my own impression is that it is in full accord with his teachings.

The study of morphology from its artistic or pictorial side led Dr. Allen, in 1875, to the publication, in the *Transactions* of the American Philosophical Society, of his suggestive treatise entitled *An Analysis of the Life Form in Art.* It covers 71 quarto pages, and the text is illustrated by 185 figures. The chief aim of the author was to analyze those art forms of early or savage peoples which have originated in models found in nature; to point out those peculiar traits in animals and plants which caught the eye of the primitive artist; and to set forth the passage from the realistic to the conventional in early design.

Such models as the palm-tree, the serpent, the man, the lion, etc., are selected as examples, and traced with minuteness in their repre-

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cated the adoption of a uniform method of describing its form and parts. In general theory, he followed Dr. James Aitken Meigs in his classification, and pointed out that the quite recent plan of Professor Giuseppe Sergi is little more than a return to Meigs' methods.

He was the first (in 1891) to suggest the term "pedomorphism" as signifying the retention of infantile and adolescent traits in the adult skull, and extended the connotation of the term to the whole skeleton. He gave this characteristic a more exact value, by showing that it is present in greater or lesser degree in every skull, and he urged that such traits should form a part of the description of every specimen.

The chief results of his studies in craniology are included in two remarkable memoirs. The earlier was published in the *Journal* of this Academy for 1896, entitled *Crania from the Mounds of the St. Johns River, Florida: a Study made in connection with Crania from other parts of North America.*

The reception which this memoir received among craniologists was most favorable. Professor Emil Schmidt, of Leipzig, one of the most competent judges in Europe, said of it at the close of a review in the *Centralblatt für Anthropologie:* "This is the most important contribution to craniological science which American scientific literature has offered for a long series of years."

It would be quite impossible to do it justice in a few words, and and it would be inappropriate here to enter into its technical details. It may be sufficient to say that it advances a new and more complete terminology than that now generally in use; that various novel and ingenious instruments for measurement are described; and that the comparisons instituted are of the most thoroughgoing kind.

These lines of thought and others of an allied nature were continued in a memoir, not yet published, but which will soon appear in the *Transactions* of the Wagner Free Institute of Science. Its subject is a series of skulls from the Hawaiian Islands, some from caves, others from shore burials.

As this memoir was completed by Dr. Allen but a few weeks before his death, it may be considered to embody his maturest opinions, and I shall give it, therefore, a somewhat full examination.

The same terminology is adopted in it, as in the previous memoir referred to, and the methods of investigation are the same or anal-

ogous. It illustrates his constant aim to establish some other, and if possible more stable, criteria of cranial comparison than those in common use; and, on the other hand, to subject the latter to a much closer criticism than they have heretofore received.

In the former direction he emphasizes the significance of the presence of the prenasal fossa as determining grade; points out the value of the infraorbital suture, which is generally neglected; and offers as entirely new the comparisons of the pyramidal process of the palatal bone and the prominence or recession of the zygoma when the skull is viewed from above. He estimates with precision the signification of pedomorphism as a sign not so much of arrested as of incompleted development.

One of the most striking results reached is, in his own words, that "the differences between the crania are not due to race, but to methods of living, and in some degree to differences of mental strength in individuals." This modest statement by no means conveys the full import of his demonstration. What his laborious, skilful, and accurate measurements show, taken in conjunction with the proved unity of race but diversity of nutrition and culture-conditions of his specimens, is that the ordinary contrasts in skull-forms, upon which many stately theories of races and schemes of prehistoric interminglings have been erected, are of such doubtful significance that they are inadequate for that purpose.

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acteristics in facial and cranial anatomy. It was clearly his intention to present this from a much wider comparative scheme had his life been spared.

He almost incidentally refers to a subject which interested him deeply and on which he would have made more extended examinations; that is, as above mentioned, the mental capacity of the individual as a distinct cause of modified skull form. While this in itself is not new, he aimed to approach it by novel tests.

The last lines of that memoir are indicative of his loftier estimate of craniology than a mere criterion of race. As such, he did not esteem it highly; but he saw in the investigation of the nutritive, psychical, cultural and morbid processes which alter the cranial contours, admirable illustrations of those profound forces which shape and mould life forms everywhere, and are the underlying momenta of all morphology, whether of plants or animals. In this comprehensive sense, craniology takes just rank among the great and leading subjects of scientific investigation.

Another feature in the memoir which will attract the student is a novel graphic method of displaying similarities and differences of skull form. Dr. Allen called it the "terrace method," and it has obvious advantages over the curvilinear graphic systems now in use.

This brief review of Dr. Allen's labors in one branch of learning would be still more imperfect did I neglect to record some of his personal characteristics as a student and teacher of science. Everywhere his work was marked by a singular modesty of claim, by entire justice to the labors of others in the same field, by gentleness in criticising their results, by constant willingness to assist those who sought information, by an earnest desire to stimulate the love of knowledge for its own sake, and by unceasing efforts to present this knowledge in its broadest relations both to human welfare and abstract science.

DR. HORN'S CONTRIBUTIONS TO COLEOPTEROLOGY.

BY JOHN B. SMITH.

When it is said that poets are born, not made, it is putting in a loose and popular form the fact that men are unequally endowed at birth; that special faculties are inborn in some who, if they are

given the opportunity to use them, become eminent in literature, art or science.

It is certain that Dr. George H. Horn was a born systematist:—a man with a genius for arranging things, for ferreting out their true relationships, for ascertaining the meaning of apparently meaningless structures, and for uniting everything into a consistent, congruent whole.

It is probable that, whatever the line of natural science taken up it would have profited by Dr. Horn's work. It is certain that the study of Coleoptera has been enormously advanced by him, and that not only were new facts added, but old, well known matter became endowed with new life and meaning under his masterly treatment.

He exhibited an interesting combination of the almost intuitive ability to reach sound conclusions characteristic of certain brilliant Frenchmen, with the power to give close attention to detail and to painfully strive after facts peculiar to many German students. It is this ability to do patient work in securing facts, and to marshal them in such order that they led irresistibly to the conclusion which he had reached, that gives his work its permanent scientific value.

It is difficult to speak of Dr. Horn without referring also to Dr. John L. Leconte:—first and always his teacher, afterward also his co-laborer. And it was wonderful how these two men supplemented [redacted]

he fixed a standard below which no future worker may fall if he desires to obtain recognition, or to be considered other than an amateur. In other countries his methods and conclusions were at first opposed, then tolerated, and now some of the younger workers are beginning to follow him. In the United States almost all recent work has been on the models furnished by him. There is only one notable exception. His influence appears strongly in almost every paper on Coleoptera that has been published in the United States during the last decade, and no doubt so long as these writers continue, this influence will be felt. He has set the example of thoroughness, and nothing else will be acceptable in the future. He has constantly taught us that individuals are parts of an aggregate species, and that species are not isolated facts or productions but parts of a great scheme which it is the work of the systematist to unravel. This is the impression gained from his work and such were his verbal statements at society and other meetings. The influence of this teaching will be felt throughout at least the present generation. In breaking away from the older schemes of classification and seeking characters, not only in one organ or any one set of organs or appendages, but everywhere on the body; in proving that nothing is too insignificant to be studied and to have a meaning, he has rendered a service, not only to Coleopterology, but to entomology at large, which will not be estimated at its true worth for some time to come.

He early impressed upon me, the important fact that the only true way to do systematic work is to ascertain how the species under consideration had developed, and this perhaps is the true secret of his success in untangling many of the problems in the classification of the Coleoptera. The certainty with which he seized upon the important characters, though sometimes almost [illegible] as well, seemed often little short of marvellous [illegible] had the clue, the persistence with which he followed [illegible] with which he showed how what was [illegible] the admiration of all who used the [illegible]

The strength of his faith in the [illegible] by the fact that several times when [illegible] warranted breaks, he predicted the [illegible] unusual combination of characters; and [illegible] most cases, actually discovered [illegible] services to Coleopterology that he [illegible]

induce other workers in other departments of entomology to accept his methods so generally.

To be recognized, a species must be described and named, and in entomology, especially, there is a great field for one afflicted by the *mihi* itch. But while, by force of circumstances, Dr. Horn was occasionally compelled to describe species singly, yet this was always a disagreeable task, the greatest number of the species named by him, and these run well over a thousand, being described in monographic or systematic papers and their relationship to those already named, properly brought out. He always claimed that there was no evidence that an insect was really suffering for the want of a name, and that no wrong would be done to it by postponing the christening for a brief period.

To him a species was not of interest in itself, or merely as a new thing that was to be named. It was of the greatest interest only when it filled a gap in a series. Species to him were steps, halting places in the march toward a specific structure or combination of structures, and he was always delighted when a particularly long stretch of territory was broken by a new discovery.

The result of this mode of looking at species is seen in his arrangement of tables and synopses; always the effort is to express the structural relations of the forms to each other, and the various lines that diverge from each obvious type. It is also shown in his description of species, which are models of clear statement in which essen-

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He never described an individual as a specific representative. He insisted that a species could never be represented by one individual, or even by one sex only. The characters of both male and female combined were necessary to make it intelligible, and the true idea of a species comprises also all of its variations in both sexes. Almost as a logical necessity he did not believe in types, and I do not think that there is a single specimen in his entire collection so labelled. In his view every specimen in his hands, when he described a species, was equally a type, and the only concession he would make toward the single example idea was to place one specimen on the label.

This is a point on which opinions vary. I am not sure that I would like to go quite so far as he in this particular. I believe that the Doctor was perfectly correct in his idea of a species. It seems to me, indeed, the only logical conception; but I am not certain that it was good policy to neglect the designation of an individual as representing the described combination. No man is infallible, and even Dr. Horn may have confused two species under one name, and the designation of an individual type would possibly save trouble afterward in selecting the particular form which should stand for the name proposed by him.

Dr. Horn was a hard worker in every sense of the word. His temperament was such that he was never really happy unless at work, and a fair day's scientific labor was always accomplished, even when the demands of his profession kept him up for almost entire nights. It needs only a reference to the publications of the American Entomological Society to get some idea of the amount of work that was accomplished, and as to its quality, the standard remains the same up to the very last paper published by him.

His work began with *Descriptions of three new species of Gorgonidæ in the Collection of the Academy*, published in the *Proceedings* for 1860, p. 233, or thirty-seven years ago.

His first entomological paper: *Descriptions of new North American Coleoptera in the Cabinet of the Entomological Society of Philadelphia*, was published in the same volume, pp. 569–571, with Plate 8.

The list of his papers comprises 240 titles, only six of them non-entomological, and in them about 150 new genera and more than 1,550 new species were characterized. The papers are not widely scattered: the *Proceedings* of this Academy, of the American Philoso-

phical Society and the *Transactions* of the American Entomological Society contain by far the greatest proportion and all the most important of them.

Yet a mere enumeration of the number of titles and of the number of genera and species described does not give an adequate idea of Dr. Horn's contribution to the literature of American Coleopterology. He never wrote merely to fill space and few of his titles represent short notes. Almost all represent the results of original study and many titles cover considerably over 100 pages of print. This print itself is usually condensed and so is the language of the author. Dr. Horn possessed in an unusual degree the power of succinct statement and he never wasted words. It was his practice to formulate his conclusions in the briefest possible manner and to present his proofs simply and without argument.

Though but 150 genera are credited to him, yet of the almost 1,900 accredited to our fauna he has studied nearly all and has actually characterized for the *Classification* by far the greatest number of them.

While the species described by him number but 1,550 yet in describing these he made known to us more clearly than they were known before, more than half of the 11,000 described North American Coleoptera. The work he did was simply stupendous and it grows on one as he considers it. Everywhere order appears out of chaos; under his touch what we had considered a hopeless tangle is [redacted]

information of others. His drawings could scarcely be called artistic, and were often the merest outlines; but somehow they seemed to show just what it was intended they should, and if not pleasing to the eye, they were decidedly instructive to the mind.

Mr. Samuel Henshaw of the Boston Society of Natural History has well expressed a general estimate as follows: "I doubt"—he writes—"if there is an entomologist with the same work to his credit, the same in amount and kind, who has left so little to be set aside or corrected, as will be found to be the case with the work of Dr. Horn."

Dr. Horn was what may be called a "closet naturalist," although with considerable experience in the field. His work was with dead and dry specimens and, while always interested in life histories or what are now termed biologies of insects, these were secondary. The specimens and the facts they represented were the things, always.

I do not believe he ever cut a section of an insect in his life and certainly never made use of any in his work. He would, therefore, be condemned as unscientific by those who see no value in work not biographic and those who consider that no sound conclusions can be reached unless a specimen has been elaborately prepared, sliced, stained, mounted and then ideally reconstructed. Yet all these are equally studies of nature and each may be scientific or the reverse. We need all the facts from every point of view and to consider one line of work superior or more essential argues the narrowness of the specialist who sees nothing good except as the result of the method followed by himself. Even the "mere species maker" whom it is at present the fashion to heap with contumely has a right to exist, for without him we could not refer intelligently to the creature whose life history is under consideration. or whose parafined corpse is undergoing "microtomy."

Dr. Horn has shown us by his labors that nature and the manner of nature's work can be as intelligently studied in preserved adult specimens as in any other stage or manner; and if his work is as well done as I believe it has been, the work of students following other paths will simply confirm his conclusions.

The aim of the scientific student should be to get at the truth, and all methods of reaching that goal are worthy of consideration. This was the conviction of Dr. Horn himself, and I believe he was right. At all events the contributions made by him to Coleopterology give him an indisputable right to rank with the best that are or ever have been workers in this Order.

The following annual reports were read and referred to the Publication Committee:—

REPORT OF THE RECORDING SECRETARY.

The average attendance at the meetings of the Academy during the past year has been 25. There has been no occasion of sufficient interest to fill the room and thus raise this average as has usually been the case in former years, while the separation of special interests into Sections, at the meetings of which communications are made, has continued to detract from the interest of the general sessions of the Academy, although the cooperation of the Biological and Microscopical Section and, less frequently, that of the Mineralogical and Geological Section, have been productive of good results.

Verbal communications have been made by Messrs. Rand, Sharp, Goldsmith, Pilsbry, J. C. Morris, Carter, Woolman, G. Vaux, Jr., S. Brown, Morsell, Skinner, Chapman, Calvert, Holman, Dixon, Heath, Keely, Conklin, Palmer, Kelly, Mercer, Schaeffer, Frazer, Allen, Peirce, Crawford, Stewart, Reese, C. Morris, Griffiths, Boyer, Wells, Garrison, Sullivan, Mrs. Bladen and Miss Walter. But few of these were reported by their authors for publication and they can, therefore, only be referred to in the written minutes of the Academy.

Four hundred and eighty-four pages of the *Proceedings* illustrated

sifor Frazer 2, Frank C. Baker 1, C. B. Moore 1, Marquis de Nadaillac 1, T. Chalkley Palmer 1, Mary A. Schively 1, Charles H. Johnson 1, Harold Heath 1, John Ford 1, Philip P. Calvert 1, E. Goldsmith 1, James E. Benedict 1, John Van Denburg 1, H. Von Ihering 1, Thomas Meehan 1. Of these 27 have been printed in the *Proceedings*, two in the *Journal*, while two others have been reported on favorably for the *Proceedings*. One paper has been returned to the author, one has been withdrawn by the author, and five are held under advisement. In addition to the above an elaborate memoir by the late Edw. D. Cope on the organic remains of the Port Kennedy Cave Deposit, probably the last work completed by the distinguished author, is in the hands of the Publication Committee, and will be presented as soon as means for the required illustrations can be secured.

Eighteen members and two correspondents have been elected. The deaths of ten members and four correspondents have been recorded, four members have been dropped from the roll for non-payment of dues, and eleven members have resigned, as follows: Arthur A. Bliss, J. S. de Benneville, Jean Fraley Hallowell, Henry T. Coates, Thomas Earle White, M. L. Orum, William Thomson, John Struthers, Edgar W. Earle, Edward C. Kirk and B. W. Griffiths.

In addition to the other societies heretofore reported as meeting in the Academy, the Philadelphia Branch of the Boston Mycological Club has been granted permission to hold its sessions in the Council room once a week at an hour not otherwise appropriated.

The Committee on cheaper rates of postage on natural history material appointed on September 5, 1893, has informed the Academy that its labors have been successful, a proposed modification of the postal laws having been adopted by the Universal Postal Union whereby specimens of natural history are admitted to the mails of the Union at the same rates as samples of merchandise. The Academy is to be congratulated that this very desirable result is due to the efficiency of its Committee, which consisted of Messrs. Calvert, Pilsbry and Woolman.

An application to the Legislature authorized March 30, 1897, for an appropriation from the public funds toward the furnishing of the new building of the Academy, was productive of absolutely no result.

The Hayden Memorial Geological Award for 1897 was conferred on Professor A. Karpinski, Director of the Geological Survey of

Russia. The medal and a draft for the annual interest on the fund were presented to the recipient of the recognition by Dr. Persifor Frazer, the Academy's representative at the 7th International Congress of Geologists, at a public session of the Congress. The Academy, as a member of the Congress, will receive its official publications.

A resolution protesting against the passage of a bill providing for the damming of the Delaware River was adopted March 30th, and transmitted to the Governor of New Jersey, who was not, however, deterred thereby from signing the bill. This and similar protests were heeded by the Legislature of Pennsylvania, and, the measure being defeated at Harrisburg became inoperative, as the two States must agree on any action affecting the Delaware River.

Three deaths occurring during the year have rendered it sorrowfully memorable in the history of the Academy. The society has indeed suffered severe loss since 1891, when the death of Dr. Leidy left a vacancy in its working force which has not in any degree been filled. Since then eight members, distinguished as original investigators or able in the administration of its affairs, have died in rapid succession. The most recent of these, Edward D. Cope, Harrison Allen and George H. Horn, were recognized throughout the scientific world as of eminence in their several specialties, each in his degree added lustre to the work of the Academy, and each left [redacted]

libraries, etc., forty-three notices that their publications have been forwarded to the Academy, together with twenty-five applications for exchange of publications and asking for deficiencies.

Twenty-one letters on various subjects have been received and twenty-six written. Fifteen circulars and invitations to the Academy to participate in Congresses or meetings, and announcements of the deaths of scientific men have been received, and when necessary acknowledged.

During the year two correspondents have been elected and notified.

The deaths of the following correspondents have been reported:

Auguste Louis Brot, of Geneva, Switzerland; elected in 1887, died August 30, 1896.

Constantin von Ettingshausen, of Gratz, Austria; elected in 1859, died February 1, 1897.

Rev. Samuel Haughton, of Dublin, Ireland; elected in 1868, died November, 1897.

Johannes Japetus Smith Steenstrup, of Copenhagen, Denmark; elected in 1878, died June 20, 1897.

Seven hundred and three acknowledgements for gifts to the library, and one hundred and ten acknowledgements for gifts to the museum have been forwarded.

Respectfully submitted,

BENJ. SHARP,
Corresponding Secretary.

REPORT OF THE LIBRARIAN.

The total of additions made to the library of the Academy since the close of November, 1896, is 5,145. Of these 4,476 are pamphlets and parts of periodicals, 651 volumes, 15 maps and three photographs.

They have been received from the following sources:—

Societies,	2,252	U. S. Dept. of the Interior,	35
I. V. Williamson Fund,	1,244	Charles P. Perot,	28
Editors,	896	Wilson Fund,	20
Authors,	219	Purchased	19
Meigs Fund,	154	Chas. E. Smith,	14
U. S. Dept. of Agriculture,	57	H. A. Pilsbry,	14
Pennsylvania State Library,	46	U. S. Dept. of State,	13

Minister of Public Works, France, ...	11
U. S. Dept. of Labor, . .	9
Persifor Frazer	8
Geological Survey of India,	7
Geological and Natural History Survey, Minn.,	7
Bernard H. Steiner . .	7
Comité Geologique Russe,	6
U. S. Treas. Department,	6
Thomas Meehan, . . .	5
Department of Mines, New South Wales, ...	5
U. S. Commission of Fish and Fisheries, . . .	4
Geological Survey of Missouri, ...	4
East Indian Government,	3
Geological Surv. of Canada,	3
Geological Survey of Alabama, ...	3
Ohio State Library . . .	3
Clarence B. Moore . . .	3
Governor-General, Indes Néerlandaises	3

Geological Survey of Iowa,	2
Mr. Wetherill, ...	2
W. W. Jefferis, . . .	2
W. E. Meehan, ...	2
Geological Survey of New York, ...	1
Trustees of the Melbourne Exhibition, ...	1
Geological Survey of Portugal, ...	1
L. Voission, ...	1
Exposition International de Bruxelles, ...	1
Department of Mines, Nova Scotia, ...	1
Angelo Heilprin, . . .	1
Charles G. Sower, . . .	1
Congrès International des Pêches Maritimes, . .	1
Benjamin Sharp, . . .	1
Samuel N. Rhoads, . .	1
Uselma C. Smith, . . .	1
Mrs. Carvill Lewis, . .	1
Wm. J. Fox, ...	1
Henry C. McCook, . . .	1

These accessions were distributed to the several departments of the library, as follows:—

Journals,	4,302	Mineralogy,	18
Geology,	181	Physical Science,	17
Botany,	112	Ornithology,	13
General Natural History,	102	Helminthology,	10
Agriculture,	52	Medicine,	9
Entomology,	47	Bibliography,	7
Anthropology,	47	Chemistry,	5
Mammalogy,	31	Geography,	5
Conchology,	30	Encyclopedias,	4
Voyages and Travels,	30	Herpetology,	1
Ichthyology,	25	Miscellaneous,	74
Anatomy and Physiology,	23		

The slight falling off in receipts from the number reported last year is owing to the decrease of appropriations, made necessary by the large expenditures for 1896. To the same cause is due the comparatively small number of volumes bound, which amounts to only 270, a large part of these being credited to the special funds, thus farther curtailing the amount available for the purchase of books.

In the cases, secured by the removal last year of the stock of publications of the Academy to the basement, have been arranged the books on Physical Science and Anthropology, the latter section of the library being more than doubled by the large collection of valuable works included in the Meigs bequest. Extensive additions of case room are required in nearly every department of the library, the maintenance of the geographical arrangement of the journals and periodicals being increasingly difficult from year to year. The plan suggested in the last report of arranging journals devoted to special subjects in connection with the special departments of the library, does not seem to meet with the endorsement of those immediately concerned, so that no transfers have been made.

A portrait in oil of the late Professor Edward D. Cope by C. A. Worrall, has been procured by subscription and added to the gallery.

The Librarian improved the occasion of his attendance last July at the Second International Library Conference held in London, to inspect the scientific sections of a number of libraries there and elsewhere throughout the United Kingdom, with the result of being able to congratulate the Academy on the extent and convenience of

arrangement of its collection of books which in both respects compares favorably with those of much older establishments. In liberality of administration the Academy is especially deserving of recognition, as, apart from the fact that under the By-Laws the books must be consulted on the premises, it places on the reader none of the restrictions almost universally met with elsewhere.

It is increasingly apparent that the growth and arrangement of the library are seriously interfered with by lack of means. If it were not for the care taken to secure the largest possible return from exchange of publications, the other resources at the disposal of the Library Committee would be entirely inadequate, and the opportunity for advanced study in the Academy would be materially curtailed. This would be now more than ever the cause of serious regret, because the library was never so much resorted to by students of kindred institutions as it has been during the past year. Not only for such readers, but more especially for our own workers, it is essential that the latest scientific literature be placed promptly on our shelves and in such binding as to make it most convenient of access with the least wear and tear. To secure these ends at least double the income now at the disposal of the Library Committee will be required.

Acknowledgement is again due Mr. Wm. J. Fox for efficient service in the library, especially during the Librarian's absence in [redacted]

in some departments, owing to the need of cases, seriously affects their examination and use by students.

The most noteworthy change in the arrangement of the museum during the year has been the transfer of the wall cases on the bird gallery to the basement of the new building, where a commodious storage department has been arranged for the reception of the great bulk of the alcoholic preparations.

The entire series of fishes and alcoholic mollusca have already been arranged in their new quarters, and are much more accessible to the student, besides being entirely protected from the dampness which, in their old situation, seriously affected the preservation of the labels.

The entire collection of fishes, numbering upward of fifteen thousand, has been catalogued by Mr. Henry W. Fowler, and supplementary labels placed inside the jars to ensure the preservation of the data.

The work of cataloguing and renovating the ornithological collection, which has been in progress for several years past, has been brought to completion.

The remounted exhibition collection is ready for removal to the third floor of the new building, as soon as sufficient cases can be procured.

A start has already been made in the furnishing of this floor, and one handsome plate-glass case has been placed in position, in which will be arranged a synoptical collection representing the principal orders of birds.

A similar case has been placed in the Pennsylvania and New Jersey room for the accommodation of the Delaware Valley Ornithological Club Collection of local birds with nests and eggs, which is now nearly complete. For the storage of bird skins additional space has been allotted adjoining the room of the Ornithological Section.

In the mammal hall attention is called to the group of Alaskan Fur Seals, collected by Dr. Sharp and Mr. J. M. Justice, which has been mounted during the year, and is now displayed in a large plate-glass case.

Numerous other animals have been mounted by the taxidermist during the past year, all of which maintain the high standard of work which has characterized the specimens prepared for museum exhibition in the past few years.

Foremost among these may be mentioned the Orang Utan, Striped Hyaena, Pacific Walrus, Cheetah and Florida Crocodile.

In the department of paleontology much valuable work has been accomplished. The large slabs containing the Icthyosauri have been removed from the old vestibule to the entrance of the new Museum on Nineteenth Street, where they can be seen to much better advantage.

The collection of vertebrate remains from the Port Kennedy Bone Cave, upon which Professor Cope did his last scientific work, has been displayed in the Pennsylvania and New Jersey Room. The entire collection of American invertebrate fossils has been rearranged during the year, and placed in systematic order as regards horizons, while upward of twelve hundred specimens have been cleaned and placed in trays.

Work on the Isaac Lea Eocene Collection has progressed regularly during the year, through the liberality of the Rev. L. T. Chamberlain, D. D. Mr. C. W. Johnson has been engaged in arranging the display collection, which has been increased to fill an additional case provided by Dr. Chamberlain early in the year.

Mr. Johnson and Mr. Burns have also done a considerable amount of field work which has added richly to the collection.

Miss Anna T. Jeanes has presented two horizontal oak cases, which have been placed on the first floor of the new museum, in [redacted]

rangement of a considerable portion of the bivalves has been made possible by the removal of part of the minerals from this gallery.

Besides those already mentioned, there have been numerous large and valuable additions to the museum during the year, as will be seen in the appended list.

Among them we would call attention to the valuable collection of marine specimens from California, presented by Mr. Harold Heath; a collection of rocks and birds from South Africa, presented by Dr. Emil Holub, through Mr. H. G. Bryant; a collection of Coleoptera from Pennsylvania and New Jersey, presented by the Feldman Collecting Social, a collection of African insects and mollusks from Dr. A. Donaldson Smith; a collection of alcoholic mammals of North America from S. N. Rhoads, as well as the numerous valuable specimens received through the year from the Zoological Society of Philadelphia. The collection of marine invertebrates preserved in formaline has also been increased through the liberality of Mr. F. W. Walmsley.

Several important improvements in the museum building are also noteworthy, particularly the fitting up of the receiving room at the east end, as an addition to the library and the renovation of the Council Room.

The Curators have also, during the year, vacated one of the small rooms on the library floor, and have allotted a large space on the basement floor of the new museum for the storage of publications.

The Curators take this occasion to express their indebtedness to various members and to the Conservators of the Sections, for valuable assistance in caring for the special collections, particulars of which will be found in their several reports.

Important assistance has also been rendered by the students of the Jessup Fund. Much assistance has been given to specialists by placing the collections at their disposal, and in addition to the many who have made use of material at the Academy, specimens have been loaned to representatives of various scientific institutions throughout the country, including Anthony Woodward, Henry C. Mercer, T. Wayland Vaughan, Fred'k. A. Lucas, L. M. Underwood, H. M. Smith, Walter Faxon, C. F. Millspaugh, H. C. Oberholser, B. L. Robinson, T. W. Stanton, Robert Ridgway and others.

HENRY C. CHAPMAN, M. D.,
Chairman of the Curators.

REPORT OF THE BIOLOGICAL AND MICROSCOPICAL SECTION.

The Section has held ten meetings during the past year with slightly increased average attendance. Communications of general interest have been made at each of the meetings, diatoms and bacteriology receiving special attention.

The Conservator reports the purchase of several new objectives. Donations to the museum were made by Dr. J. C. Morris, and a large aquarium was presented by Mr. Holman. The following communications were made to the Academy:

"Demonstration of Absorption of Carbon Dioxide and of the Generation of Oxygen by Diatoms," by T. Chalkley Palmer.

"Dentition of Snails," by Professor Pilsbry.

"Furs," by Dr. Morris.

"The Neuron," by Dr. A. O. J. Kelly.

"Structure of the Diatom Valve," by F. J. Keeley.

The officers of the Section are as follows:

Director, ...	J. Cheston Morris, M. D.
Vice-Director, ...	T. Chalkley Palmer.
Treasurer, ...	Charles P. Perot.
Conservator, ...	F. J. Keely.
Corresponding Secretary, . .	John G. Rothermel.
Recorder, ...	Charles S. Boyer.

[redacted]

which are at present being monographed in the *Manual of Conchology*; the collection of Helices having extended over the cases formerly containing Bulimi.

Other museum work worthy of note has been a thorough revision of the Ampullariidæ, Pinnidæ, Pectunculus and Amphidromus of the collection, by Miss J. E. Letson, and a revision of the Arionidæ and Cylindrellidæ by Mr. E. G. Vanatta and the Conservator.

The recent and fossil Scaphopoda of our collection have been studied by the Director and Conservator of the Section, and the specimens relabelled; the results of the study being embodied in a monograph of the group in the *Manual of Conchology.*

The entire collection of alcoholic mollusks has been transferred from the mollusk gallery wall cases, to cases erected in the basement of the new building, where they have been arranged in systematic order.

The routine work of identifying specimens for correspondents has as usual occupied considerable time; but as in former years a large number of species new to science have resulted from the time thus expended. 1,505 lots of specimens from 72 persons have been received, labelled and placed in the collection during the year. A detailed list of accessions will be found in "Addition to the Museum."

The officers of the Section are as follows:

Director,	Benjamin Sharp, M. D.
Vice-Director,	John Ford.
Recorder and Librarian,	Edw. J. Nolan, M. D.
Corresponding Secretary,	Chas. W. Johnson.
Treasurer,	S. Raymond Roberts.

Respectfully submitted,

HENRY A. PILSBRY,
Conservator.

REPORT OF THE ENTOMOLOGICAL SECTION.

Six meetings has been held during the present year. The attendance has been good and many interesting and valuable verbal communications have been made. The year has been an eventful one in the history of the Section. More commodious quarters have been occupied and work in all of the orders of insects has been consequently stimulated. The collections are in better condition than ever

before and they are being well protected against museum pests. The Section has been fortunate in having aid from a number of its members interested in special branches of entomology. Dr. H. G. Griffith has done excellent work in the rearrangement of the exotic Coleoptera and Mr. Gerhard has worked industriously on the Martindale Lepidoptera. A number of valuable collections have been presented and many small lots of insects. These are enumerated in the list of additions to the museum. It is hoped that the display collection in the museum may be rapidly increased for the benefit of the visiting public. So far as the collections for study are concerned, little is to be desired, as in a number of the orders we have the finest collections of American species in the world.

Ten numbers of the *Entomological News* have been published forming 256 pages and 11 plates. At the meeting of the Section held Dec. 23rd. the following were elected to serve as officers for the coming year:

Director, ...	Chas. S. Welles.
Vice-Director, ...	Philip Laurent.
Treasurer, ...	E. T. Cresson.
Conservator and Recorder, . . .	Henry Skinner.
Secretary, ...	Wm. J. Fox.
Publication Committee, ...	J. H. Ridings. C. W. Johnson.

HENRY SKINNER,

[redacted]

fund, the interest of which should go to the care and increase of the collection of plants. These have been disposed of, the Herbarium being secured for $1,700 by the Missouri Botanical Garden, and the books sold at auction. The fund will be known as the Redfield Memorial Herbarium Fund. The investment now made will yield a small income next year, which will help in the purchase of new collections. No attempt has been made the past year to add to the fund, as it was not thought wise to interfere with the applications of the Academy for aid in other directions.

The Section is free from debt, and has a small balance in its treasury.

The officers for the ensuing year are:

Director, ...	Thomas Meehan.
Vice-Director, ...	Charles E. Smith.
Conservator and Treasurer, . .	Stewardson Brown.
Recorder, ...	Chas. Schäffer, M. D.
Corresponding Secretary, . .	Jos. D. Crawford.

Respectfully submitted,

THOMAS MEEHAN,
Director.

Report of the Conservator.—Notwithstanding the disadvantages under which the Botanical Department has had to work, the result for the past year has been fully up to those preceding.

The mounting of the collections has been steadily carried on through the untiring efforts of the Director of the Section, and is now completed up to Gentianaceæ. It is hoped to have them all properly arranged by the end of the next season.

The Lewis and Clark Collection has been carefully examined by Mr. Thos. Meehan and Professor B. L. Robinson of Harvard College.

There is every reason to expect that before the next report shall be made, the much needed cases for accommodation of the rapidly accumulating material will have been secured. The accessions of the year are recorded in the list of additions to the Museum.

I wish to congratulate the Section on the good work of the year, and to thank all those who have contributed to its performance.

STEWARDSON BROWN,
Conservator.

REPORT OF THE MINERALOGICAL AND GEOLOGICAL SECTION.

Ten meetings of the Section have been held during the year with an average attendance of more than nine members.

An active interest has shown itself at the meetings, communications having been made by many of the members and by visitors. Of these may be mentioned several on geology, especially of the vicinity, on the composition of soils, on a new mineral called Trisaltite by Mr. Goldsmith, on glacial striæ and rubbings made from them, and on a large deposit of corundum, in gneissoid or granitic rocks in Ontario.

Two successful excursions were enjoyed by the Section: one on May 27th to Media, Mineral Hill, and the Sharpless quarry and the other on October 23rd to the quarries, etc. near Avondale, Chester Co.

The Officers of the Section are as follows:—

Director, ...	Theodore D. Rand.
Vice-Director and Conservator, . .	Wm. W. Jefferis.
Recorder, ...	Charles Schäffer.
Treasurer, ...	John Ford.

Respectfully submitted,

THEO. D. RAND,

Director.

REPORT OF THE ORNITHOLOGICAL SECTION.

It is gratifying to be able to report the completion of the work of renovating the mounted collection of birds in the museum of the Academy. This work was begun in 1892 and has progressed steadily ever since, though press of other museum work has often occasioned

[redacted]

All the specimens are numbered to correspond with the catalogue and all data have been preserved on the bases of the stands.

The Conservator is now engaged in a careful study of the numerous type specimens contained in the collection, the results of which will be published in the *Proceedings* of the Academy, so that the important facts relative to this famous collection may be properly preserved.

During the past year the completion of the work above described has involved the remounting of 500 specimens, the writing of 2,000 labels and the entry of 5,000 specimens in the permanent catalogue.

Besides this the entire collection was rearranged in the exhibition cases to bring it into proper sequence.

The Section's quarters have been still further enlarged by the allotment of additional space on the floor adjoining its room to accommodate the additional cases of skins. The whole study-series has been carefully examined and found to be in excellent condition.

The accessions for the year comprise an important collection of North Carolina birds presented by Robt. T. Young, a small collection of African species from Dr. Emil Holub and numerous specimens received from the Zoological Society. The Delaware Valley Ornithological Club has also added many rare and artistic groups of nests and eggs to the collection of Pennyslvania and New Jersey birds, and by its meetings at the Academy, has been instrumental in keeping up a live interest in this branch of science.

The Stone Collection of Pennyslvania and New Jersey birds numbering upward of 2,000 skins has been received on deposit and is at the disposal of students who may desire to consult it.

In reviewing the work of the year the Conservator wishes to express his acknowledgment of the valuable assistance rendered by Mr. Henry W. Fowler.

At the annual meeting of the Section held December 20, 1897, the following officers were elected:—

Director, ...	Spencer Trotter, M. D.
Vice-Director, ...	George S. Morris.
Recorder, ...	Stewardson Brown.
Secretary, ...	William A. Shryock.
Treasurer and Conservator, . .	Witmer Stone.

WITMER STONE,
Conservator.

REPORT OF THE ANTHROPOLOGICAL SECTION.

Five meetings have been held during the past year, at which communications were made by Prof's. Brinton, Allen, and Culin, and a special communication on "Primitive Transportation," by Prof. Otis T. Mason, of the National Museum, Washington, D. C. A committee was appointed to consider the question of obtaining space in the old museum hall for the collection of crania possessed by the Academy. Mr. John G. Rothermel was elected Treasurer, to succeed Dr. M. V. Ball, resigned. The death of Dr. Harrison Allen left vacant the Directorship, which office he has filled since the organization of the Section. At the December business meeting a quorum was not present, and the annual election could not he held, the officers of the Section being continued until the next meeting. The office of Director remains vacant.

CHARLES MORRIS,
Rocorder.

REPORTS OF THE PROFESSORS.

ANGELO HEILPRIN, PROFESSOR OF GEOLOGY, reports that the work in his department during the past year has been confined mainly to its educational aspect. The regular spring course of instruction was comprised in twenty-six lectures and eight field dem- [redacted]

ceived from various sources, a number of them from former students of the courses of geology. While the generous gift of the late Prof. E. D. Cope does not strictly concern the department of geology, as defined by the By-Laws, a reference to it cannot be omitted. Prof. Cope's collections are not only a monument to the indomitable energy and scientific devotion of a master of his specialty, but of the utmost importance to the student of vertebrate paleontology. The collections should be secured for the Academy, to which they have been virtually proffered, and with which the name of the deceased has been most intimately associated.

Daniel G. Brinton, M. D., Professor of Ethnology and Archæology, reports that during the spring of 1897, a course of free public lectures was delivered by him in the lecture hall of the Academy on the recent advances in the science of anthropology. The lectures were well attended, and an increased popular interest in this branch was manifest.

The anthropological collections of the Academy have been arranged in mostly new cases and exposed to public view in a favorable portion of the recently constructed addition to the Academy building. The number of visitors who give attention to this portion of the collections of the Academy show that it is one in which the general public is much interested.

Benjamin Sharp, M. D., Professor of Invertebrate Zoology, reports that during the past year he delivered two courses, one of ten and the other of six lectures, upon invertebrate zoology, under the auspices of the Ludwick Institute, and one lecture in the Friday Evening Course on "The Sea and its Influence upon Animal Life."

The additions to the museum have not been extensive, the most important being the collection of invertebrates made by the Alaskan and Siberian Expedition.

Henry A. Pilsbry, Professor in the Department of Mollusca, reports that he has delivered two courses of lectures upon Malacology during the year.

Several reports upon particular groups of mollusks, both recent and fossil, based upon material in the collection of the Academy have been prepared and published in the *Proceedings*, together with others based upon material sent for investigation from abroad. Progress has been made in the classification and arrangement of the

collection, the details of which may be found in the report of the Conservator of the Conchological Section.

HENRY SKINNER, M. D., PROFESSOR IN THE DEPARTMENT OF INSECTA, reports fully on the condition of the entomological collections, his statements being included in the report of the Entomological Section. He will deliver six lectures in the Academy's Ludwick Institute Course early in the coming year.

The election of Officers, Councillors and Members of the Finance Committee to serve during 1898, was held with the following result:—

President, ...	Samuel G. Dixon, M. D.
Vice-Presidents, ...	Thomas Meehan.
	Rev. Henry C. McCook, D. D.
Recording Secretary, . .	Edward J. Nolan, M. D.
Corresponding Secretary, .	Benjamin Sharp, M. D.
Treasurer, ...	George Vaux, Jr.
Librarian, ...	Edward J. Nolan, M. D.
Curators, ...	Henry A. Pilsbry.
	Henry C. Chapman, M. D.
	Arthur Erwin Brown.
	Samuel G. Dixon, M. D.
Councillors to serve three years,	Charles P. Perot.
	C. Newlin Peirce.
	Theodore D. Rand.
	Philip P. Calvert.
Finance Committee, . . .	Charles Morris.
	Chas. E. Smith.
	Uselma C. Smith.
	William Sellers.
	Charles P. Perot.
Councillor for unexpired term of two years, . . .	Charles H. Cramp.

ELECTIONS DURING 1897.

MEMBERS.

January 26.—William Biddle Cadwalader, Charles J. Pennock.

February 23.—Thomas H. Montgomery.

March 30.—Bartram W. Griffiths, E. T. Stotesbury, Robert K. McNeely, Louis Weber, M. D.

April 27.—Henry Brinton Coxe, Ferdinand Philips, Eckley Brinton Coxe, Jr.

May 25.—Sager Chadwick.

June 29.—Alonzo H. Stewart, M. D., Chas. E. De M. Sajous, M. D.

September 28.—Thomas H. Conarroe, M. D., G. A. Muller, Katherine Muller.

October 26.—Daniel Baugh.

November 30.—J. Waln Vaux.

CORRESPONDENTS.

May 25.—Alexander Karpinski of St. Petersburg, Russia.
November 30.—Fridtjhof Nansen of Christiania, Norway.

COUNCIL AND STANDING COMMITTEES FOR 1898.

COUNCIL.

Officers.—Samuel G. Dixon, M. D., Thomas Meehan, Rev. Henry C. McCook, D. D., Edw. J. Nolan, M. D., Benjamin Sharp, M. D., George Vaux, Jr., Henry A. Pilsbry, Henry C. Chapman, M. D., Arthur Erwin Brown.

To serve Three Years.—Charles P. Perot, C. Newlin Peirce, Theodore D. Rand, Philip P. Calvert.

To serve Two Years.—Thomas A. Robinson, Charles H. Cramp, Charles Morris, Isaac J. Wistar.

To serve One Year.—Uselma C. Smith, Charles E. Smith, John Cadwalader, William Sellers.

STANDING COMMITTEES.

Finance.

Uselma C. Smith, Charles Morris, Charles E. Smith, William [redacted]

ADDITIONS TO THE MUSEUM.

MAMMALS.

Dr. Thos. Biddle. *Tarsius fuscus* dissected, in alcohol.

Henry G. Bryant. Skin of marmot, Alaska.

Dr. H. C. Chapman. Two specimens of *Pteropus* in alcohol. Embryos of *Macropus* and *Canis dingo*, dissected specimens in alcohol of *Loris gracilis*, *Galago crassicaudata*, *Ornithorhynchus* and *Nyctecebus*

Dr. S. G. Dixon. *Lepus aquaticus*, Alabama, (mounted).

Dr. Emil Holub. Mounted Jerboa and Jackal and eight skulls of mammals, South Africa.

Dr. W. E. Hughes. *Atalapha borealis* (mounted).

Medico-Chirurgical College. Two skulls and odd bones of Elephant.

Purchased by subscription. Male Orang Utan (*Simia satyrus*) lived in the Zool. Society's Garden, Nov., 1893 to Nov. 1, 1897, mounted Nov., 1897.

S. N. Rhoads. Collection of 60 jars of alcoholic mammals from N. America. Specimens of *Lepus sylvaticus*, New Jersey (mounted). *Sigmodon hispidus floridanus* (mounted). Three fœtal *Lynx rufus*, Clinton Co., Pa.

R. T. Young. Skin and skull of *Fiber zibethicus*.

Zoological Society of Philadelphia. The following mammals which have been prepared as indicated. Mounted: Crab-eating Raccoon *Procyon cancrivorus*, *Gazella muscatensis* ♀, Sacred Monkey, *Semnopithecus entellus*; Dusky Monkey, *Semnopithecus obscurus*; Cheetah, *Cynælurus jubatus* ♀; Campbell's Monkey, *Cercopithecus campbelli*; Striped Hyæna, *Hyæna striata*; Black Macacue, *Macacus maurus* ♀; Striped Wallaby, *Macropus dorsalis* ♀; Coati, *Nasua nasua*; Caribbean Seal, *Monachus tropicalis*; Ocelot, *Felis pardalis*; Bengal Cat, *Felis bengalensis*; Brush-tailed Wallaby, *Petrogale penicillata*: also, to be mounted, Young Elk, *Cervus canadensis*; Fallow Deer, *Cervus dama* ♂. Red Kangaroo female with young, *Macropus rufus*.

Skins. Black spider Monkey, *Sapagou vellerosus*; Prairie Dog, *Cynomys ludovicianus*; Two Common Seals, *Phoca vitulina*; Common Paradoxure, *Paradoxurus*; Brown Capuchin, *Cebus fatuellus*; Monkey (sp. undet.); Javan Civet, *Viverra tangalunga*, Barbary Ape, *Macacus inuus*.

Osteological preparations. Skulls of all the mounted animals and skin specimens; also of Young Camel, *Camelus sp.*; Prong-horned Antelope, *Antilocapra americana.*

Disarticulated Skeletons of Pronghorned Antelope, *Antilocapra americana;* Two Gillespie's Seals, *Zalophus californianus;* Indian Buffalo, *Bos buffelus;* Coon-like Dog ♂, *Canis procyonoides;* Brush-tailed Wallaby, *Petrogale penicillata;* Rhesus Monkey, *Macacus rhesus;* Javan Civet, *Viverra tangalunga;* Two Caribbean Seals, *Monachus tropicalis;* Monkey (sp. undet.).

Rough Skeletons. Chamois, *Rupicapra tragus;* Indian Buffalo, *Bos buffelus;* Camel, *Camelus dromedarius.*

BIRDS.

H. L. Albright. Three specimens of *Loxia curvirostra minor*, Lycoming Co., Pa. (skins).

Henry G. Bryant. *Olor columbianus* (mounted) and skin of *Uria mandti.*

H. R. Deacon. *Urinator imber*, Seaville, N. J. (skin).

Delaware Valley Ornithological Club Collection. Fifteen nests and sets of eggs of Pennsylvania and New Jersey birds and twenty mounted birds presented by members of the Club. Nest of Yellow-billed Cuckoo, (*Coccyzus americanus*) from Mrs. Edw. Robins, Goshawk, *Accipiter atricapillus* from Chas. A. Shriner; Wood Ibis (*Tantalus loculator*), from Dr. Park P. Breneman. Gannet (*Sula*

[redacted]

ton, *Olor buccinator*, *Grus stanleyi;* Skull and Sternum, *Ciconia nigra*, *Phasianus reevesi;* Skin, *Garrulax picticollis*, *Rhamphastos discolorus*, *Garrulus glandarius*, *Trupialis defilippi*, *Polytelis melanurus*, *Nucifraga caryocatoctes*, *Branta bernicla*.

Ardea virescens caught in Logan Square (mounted).

REPTILES.

Dr. Harrison Allen. Three jars of Reptiles.

Dr. Thos. Biddle. *Ophibolus doliatus*, Pennsylvania.

Arthur Erwin Brown. *Eutænia vagrans* and two specimens of *Sceloporus consobrinus*.

Dr. H. C. Chapman. Dissection of *Sphenodon punctatus*. Carapace and plastron of *Chelopus insculptus*.

Edw. D Cope. Collection of reptiles from Vera Cruz, Mexico.

Chas. E. Ridenour. Three young Anacondas.

F. W. Walmsley. *Ophibolus getulus* and *doliatus*, New Jersey.

H. W. Wenzel. *Pseudemys rugosa*, Philadelphia.

Lieut. H. L. Willoughby, U. S. N. *Crocodilus americanus*, Florida (mounted).

Zoological Society of Philadelphia. Two specimens of *Xiphosoma ruschenbergeri*.

FISH.

Dr. Harrison Allen. Specimens of *Echelus conger*.

Dr. H. C. Chapman. Dissection of *Squalus*, *Astroscopus anophis*, two young *Cyclopterus*, *Polypterus bichir*. Skeleton of the head of *Lophius piscator*.

D. Morgan Eldridge. Head of Rabbit-fish (*Lagocephalus*).

Wm. Ellis. Two specimens of *Zoarces anguillaris*.

W. J. Fox, Series of *Fundulus*, Atlantic City, N. J.

Harold Heath. Large series of fishes from Pacific Grove, California.

Dr. C. P. Henry. Puffer fish (*Tetradon*), dried.

Mrs. Tiel. Specimen of *Cyclopterus lumpus*.

INSECTS.

Dr. A. Donaldson Smith. 207 Orthoptera, 130 Diptera, 262 Hemiptera, 4 Coleoptera, 31 Neuroptera, 77 Lepidoptera, 160 Hymenoptera, all from N. E. Africa.

Feldman Collecting Social. Sixteen boxes of Coleoptera, containing 656 genera, 1,326 species, numbering 3,823 specimens.

Dr. Henry Skinner. Five hundred and ninety-six exotic butterflies.

C. H. Hutchinson. Seventy-two butterflies mounted on plaster tablets.

G. F. Russell. Two hundred specimens, various orders, collected in U. S. of Columbia.

Prof. Ellison A. Smyth, Jr. Six exotic butterflies.

Dr. Jos. H. Romig. Twenty Alaskan butterflies.

RECENT MOLLUSCA.

T. H. Aldrich. *Goniobasis* from Tallapoosa river, Alabama. Four species land shells from Sumatra.

Mr. C. F. Ancey. *Helix subaperta*, from Algeria.

E. H. Andrus. Five fresh-water species from Oregon.

J. S. Arnheim. Thirteen species shells from California and Alaska.

N. T. Bednall. *Acanthochites variabilis* from Australia.

W. G. Binney. *Prophysaon* and *Hesperarion* from California.

Frank Burns. *Glandina truncata* from Gregg's Landing, Fla.

Mr. F. L. Button. Four species land and freshwater shells, from California.

E. B. Chope. Land shells from Florida.

George Clapp. *Polygyra profunda* and *exoleta* from Virginia. *Polygyra devia* var. *Clappi* from Idaho.

T. D. A. Cockerell. Four species land shells from California and New Mexico.

H. S. Conrad. *Helix nemoralis*, New Jersey.

J. C. Cox. Thirteen species of *Ischnochiton* and other marine shells from Australia.

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J. G. Malone. *Limax*, *Prophysaon*, etc. from Oregon.

William A. Marsh. Two species of Unio from Texas.

E. H. Matthews. *Acanthochites asbestoides* from South Australia.

H. C. Mercer. Three speciés land and fresh-water shells from Tennessee.

T. L. Montgomery. *Eulota similaris* from Bermuda.

Clarence B. Moore. *Pecten nodosus* from Georgia.

Wm. Moss. *Thysanophora bactricola* from Trinidad.

N. S. Olliver. *Helix hortensis* from Nantucket.

H. A. Pilsbry. Fifty-two species American land and fresh-water shells.

P. B. Randolph. *Prophysaon*, etc. from Washington,

S. N. Rhoads. Thirteen land and fresh-water species from Tennessee.

S. Raymond Roberts. Eighteen species marine shells from New Zealand. Four land and fresh-water species from Tasmania and Japan.

Dr. W. H. Rush. Eighty-eight species shells from South America and Cape Verde Is.

G. F. Russell. Collection of shells from British Guiana.

F. A. Sampson. *Planorbis opercularis* from San Francisco, Cal.

Morris Schick. *Carychium exile* from Philadelphia.

Dr. Benj. Sharp. Ninety species marine mollusks from Alaska and Siberia. Four species from Leipzig, Germany.

Erwin F. Smith. *Limax agrestis* from Washington, D. C.

Herbert H. Smith. Sixteen species, West Indian and South American land shells.

U. C. Smith. *Limax variegatus*, from Philadelphia, and marine shells from the New Jersey coast.

Mrs. C. G. Sower. Thirteen species of shells from Italy.

Dr. V. Sterki. Sixty-four species, Ohio, land and fresh-water shells.

Witmer Stone. *Dentalium longitrorsum* Rve. and other shells.

Prof. de la Torre. Five species *Cerion* from Cuba.

United States National Museum. *Cyclomorpha flava* Brod. from Tahiti.

E. G. Vanatta. Forty-three species of land and fresh-water shells.

H. D. Van Nostrand. *Donacilla picta* from Japan.

A. Vayssiere. Ten species of Chitons from France.

C. H. Walker. *Lyogyrus Brownii* from Chelsea, Mass.

F. W. Walmsley. Numerous mollusks preserved in formaline.

H. W. Wenzel. Two species from Pa. and New Jersey.

Wm. Wharton. *Ampullaria reflexa* from Carthagena.

J. J. White *Sunetta* and *Pectunculus* from Ceylon.

Lewis Woolman. *Anodonta fluviatilis* Dillw.

Yucatan and Mexican Expedition. Twenty-four species marine mollusks.

LOWER INVERTEBRATES.

Harold Heath. Collection of Invertebrates, Pacific Grove, Cal.

David Milne. Star-fish.

Dr. W. H. Rush. Eight trays of dried Crustacea.

G. F. Russell. Three jars of invertebrates.

W. L. Savage and others. *Squilla empusa*, Cape May, N. J.

Witmer Stone and F. H. Brown. Collection of marine Invertebrates, N. J. coast.

F. W. Walmsley. Collection of various marine Invertebrates, preserved in formaline.

INVERTEBRATE FOSSILS.

H. W, Bishoff. *Orthoceras*, Dauphin Co., Pa.

A. P. Brown. Collection of Invertebrate fossils from Kansas.

S. H. Hamilton. Cretaceous fossils from Salem, N. J.

Wilfred Harned. Two specimens of *Hemiaster*.

Mr. and Mrs. R. T. Hill. A collection of Invertebrate fossils from various localities.

Dr. Emil Holub. Fossil mollusca from Hungary.

H. C. Mercer. Collection of fossil mollusca from Virginia.

Edw. D. Ross. Nine trays of Invertebrate fossils, from New South Wales.

[redacted]

W. W. Jefferis. Five species of North American Plants.

Thomas Meehan. Two hundred and twenty-five species of South African Plants collected by Schlichter, two hundred species of Asia Minor Plants collected by Bornmuller, five hundred species of South American Plants collected by Rusby, twelve species of North American Plants.

Miss Piert. Specimens of *Brodica capitata.*

Silas L. Shumo. Twenty-five species of Pacific Coast Algæ.

United States Department of Agriculture. Two hundred and fifty species of North American Grasses.

United States National Museum. Nine species of North American Plants.

Miss Mary Vaux. Specimen of *Larix lyelii.*

Newlin Williams. Specimen of *Euphrasia officinalis.*

Lewis Woolman. Specimen of *Berberis napensis* and *Vaccinium Pennsylvanicum.*

MINERALS, ROCKS, ETC.

E. C. Atkinson. Large collection of minerals.

Clarence Bement, in exchange. Two meteorites.

H. H. Bisling. Mineral fragments, Wyoming.

Dr. H. C. Chapman. Series of wooden models of crystals.

E. D. Cope. Box of rocks, Missouri.

W. C. Desmond. Collection of Minerals.

E. Goldsmith. Specimen of Carborundum.

W. W. Jefferis. Diaspore; Gold ore, Canada; Rhombohedral Quartz, Amethyst.

S. H. Hamilton. Specimen of Marble.

Wilfred Harned. Pictou Coke.

Dr. E. Holub. Series of specimens of earth and rock from the diamond diggings of South Africa.

W. T. Merrick, Box of rock specimens, Blossburg, Pa.

Mineralogical and Geological Section. Malachite, Montgy. Co., Pa. Contorted Gneiss, Delaware Co., Pa. Several large rock specimens.

Theo. D. Rand. Altered diorite, Staurolite in mica schist.

Jacob Reese. Box of Carborundum.

J. E. Richardson. Limonite pseudomorph after Pyrite; Molybdenite.

Edw. D. Ross. Six specimens of Ore, Broken Hill Mine, New South Wales.

Thos Sheehan. Dredgings, Lake drainage excavation, Chicago.

Witmer Stone. Several rock specimens from vicinity of Philadelphia.

S. Tyson. Three species of minerals. Two specimens Cuprite.

Purchased for the Wm. S. Vaux collection during the year 110 specimens.

Archæology.

H. Burcam. Arrow Head, Tennessee.
H. H. Bisling. Arrow Head, Wyoming.
Dr. S. G. Dixon. Arrow Head, Floyd Co., Ga.
Dr. H. C. McCook. Toy Eskimo Sled, Greenland.
Clarence B. Moore. Large collection from the mounds of Georgia.
J. D. Reed. Arrow Head.
Sydney Sharp. South African Shield.
Curwin Stoddart. Japanese, Storm Coat.
John H. Weeks. Arrow Head.

Miscellaneous.

J. Dundas Lippincott. Case of Microscopical Slides.

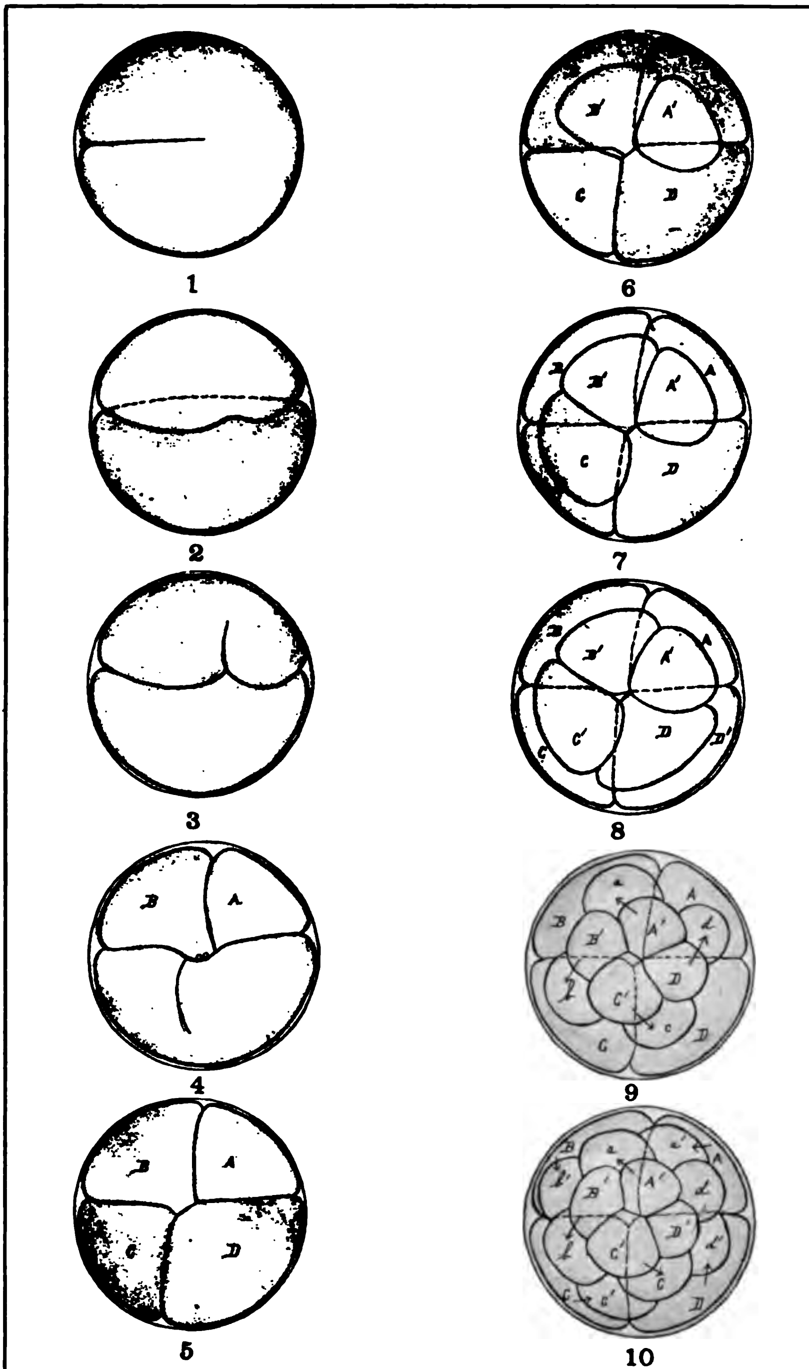
INDEX TO GENERA, ETC., 1897.

[redacted]

[redacted]

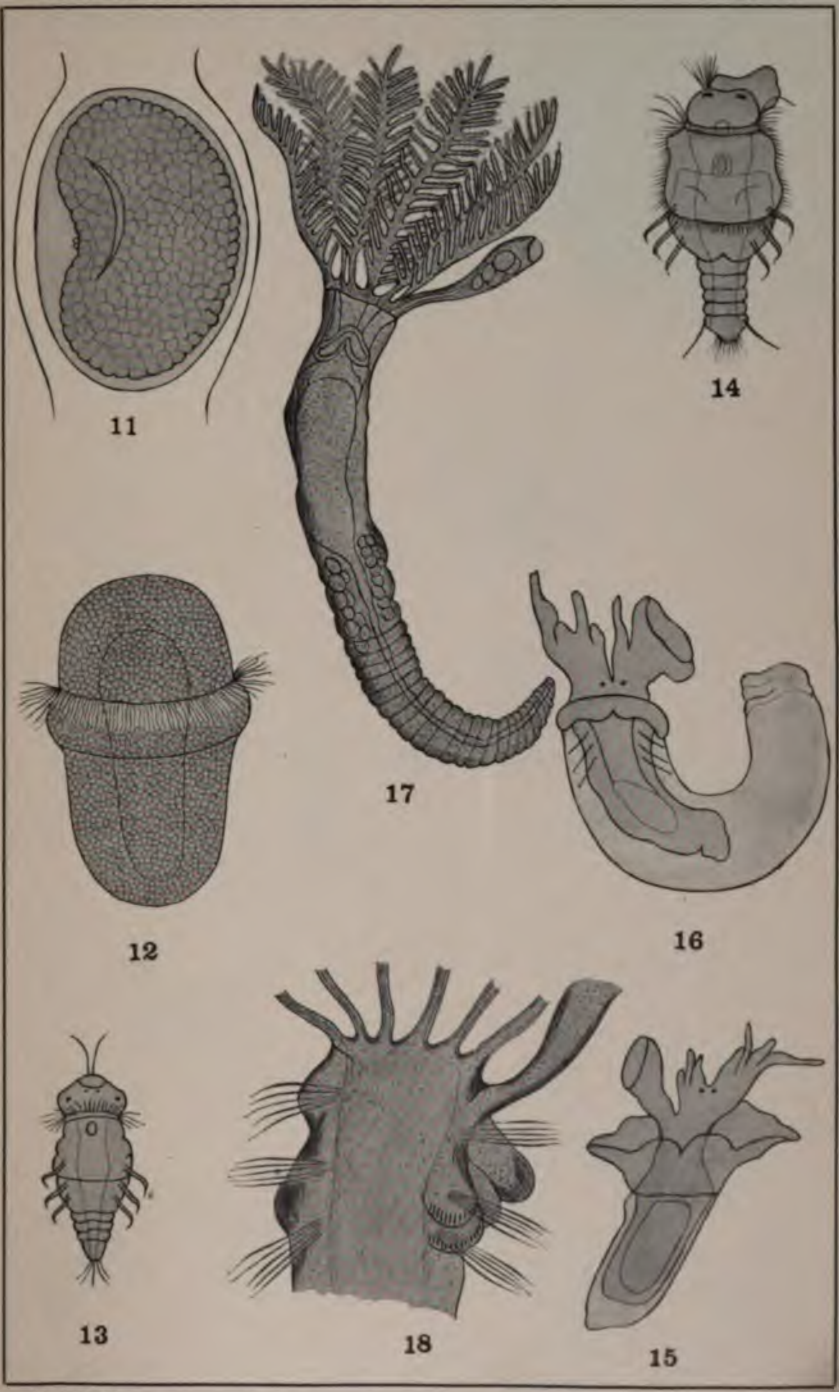
GENERAL INDEX.

1897.

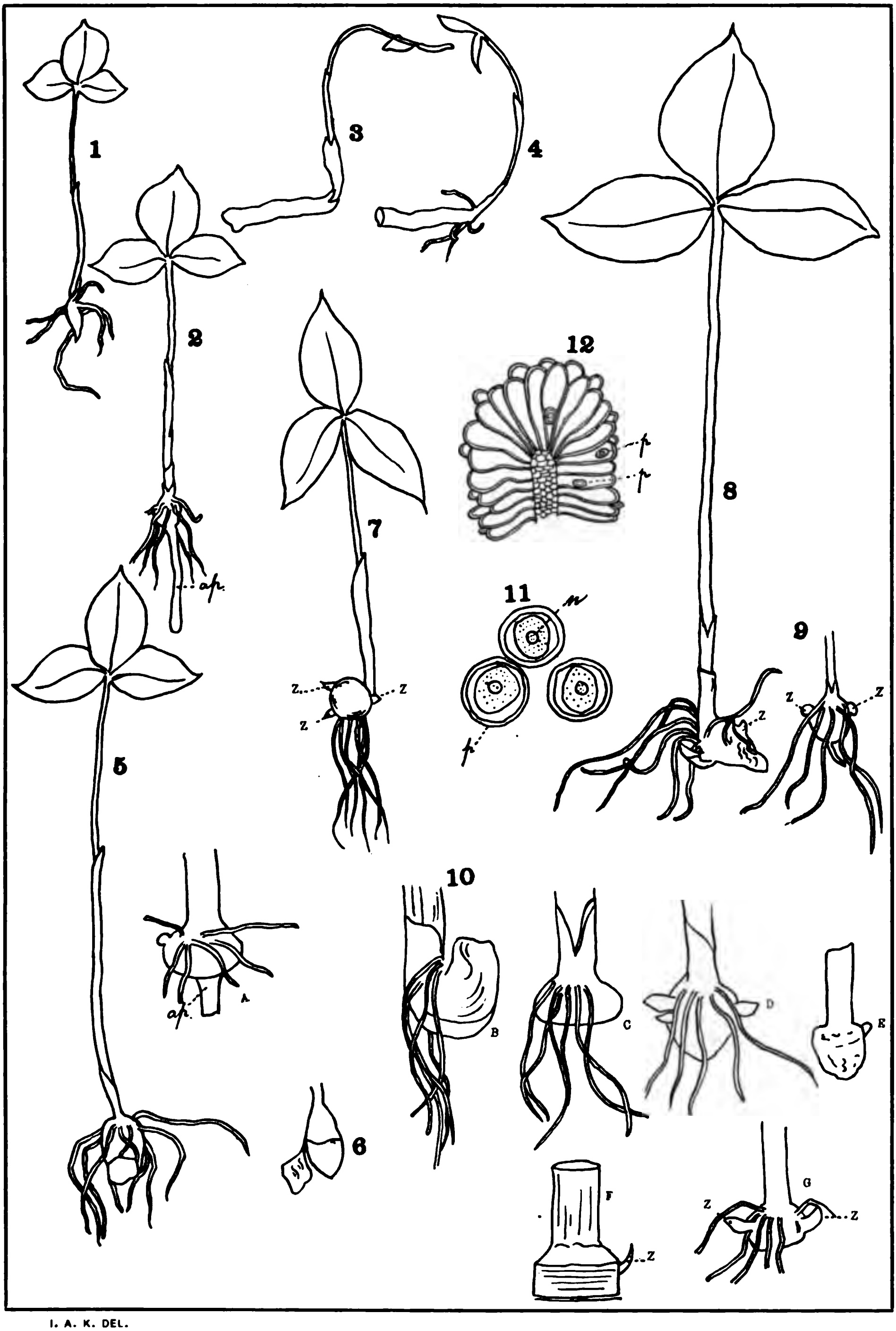


M. A. S. DEL.

SCHIVELY ON SPIRORBIS.

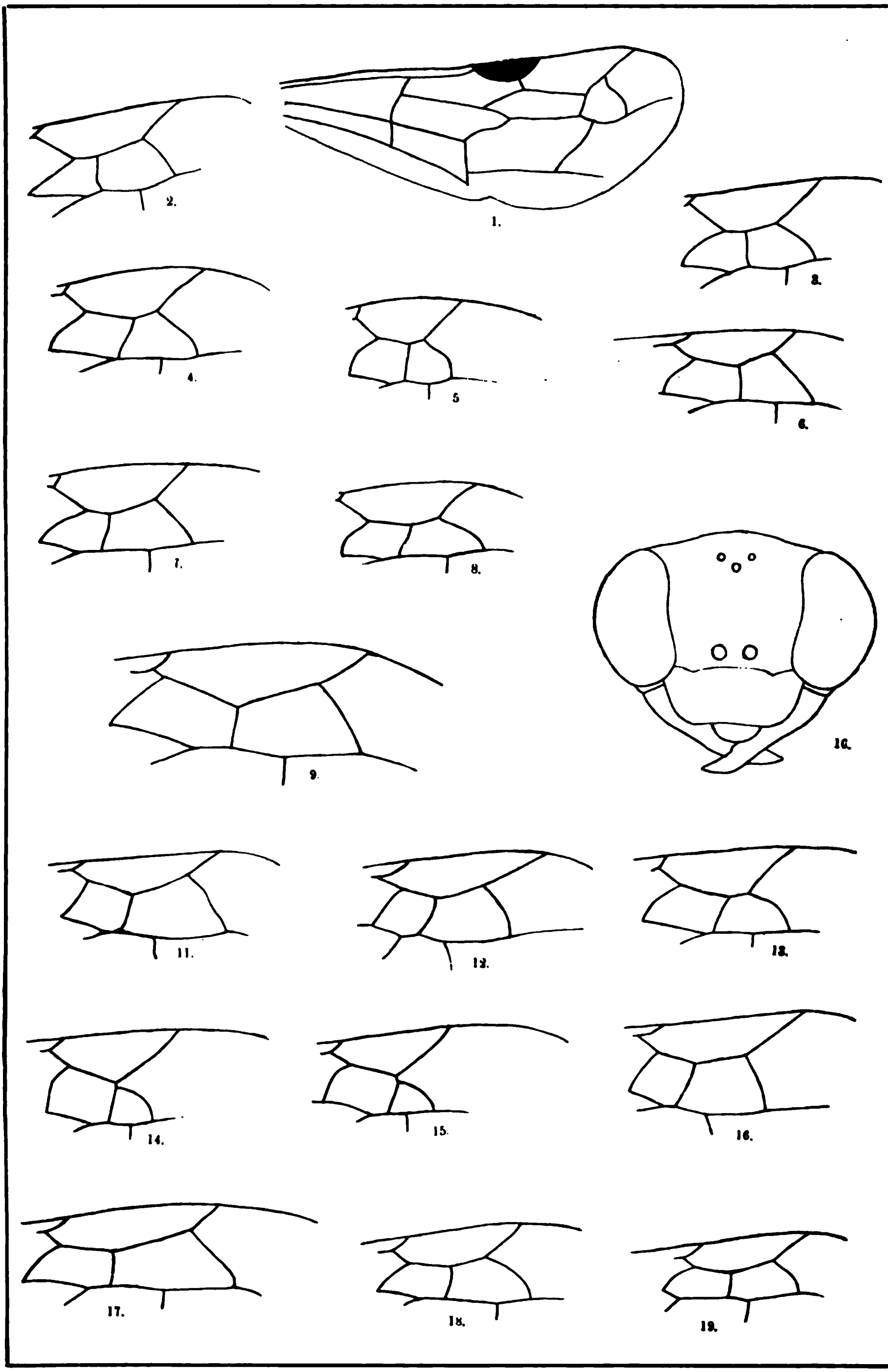


SCHIVELY ON SPIRORBIS.

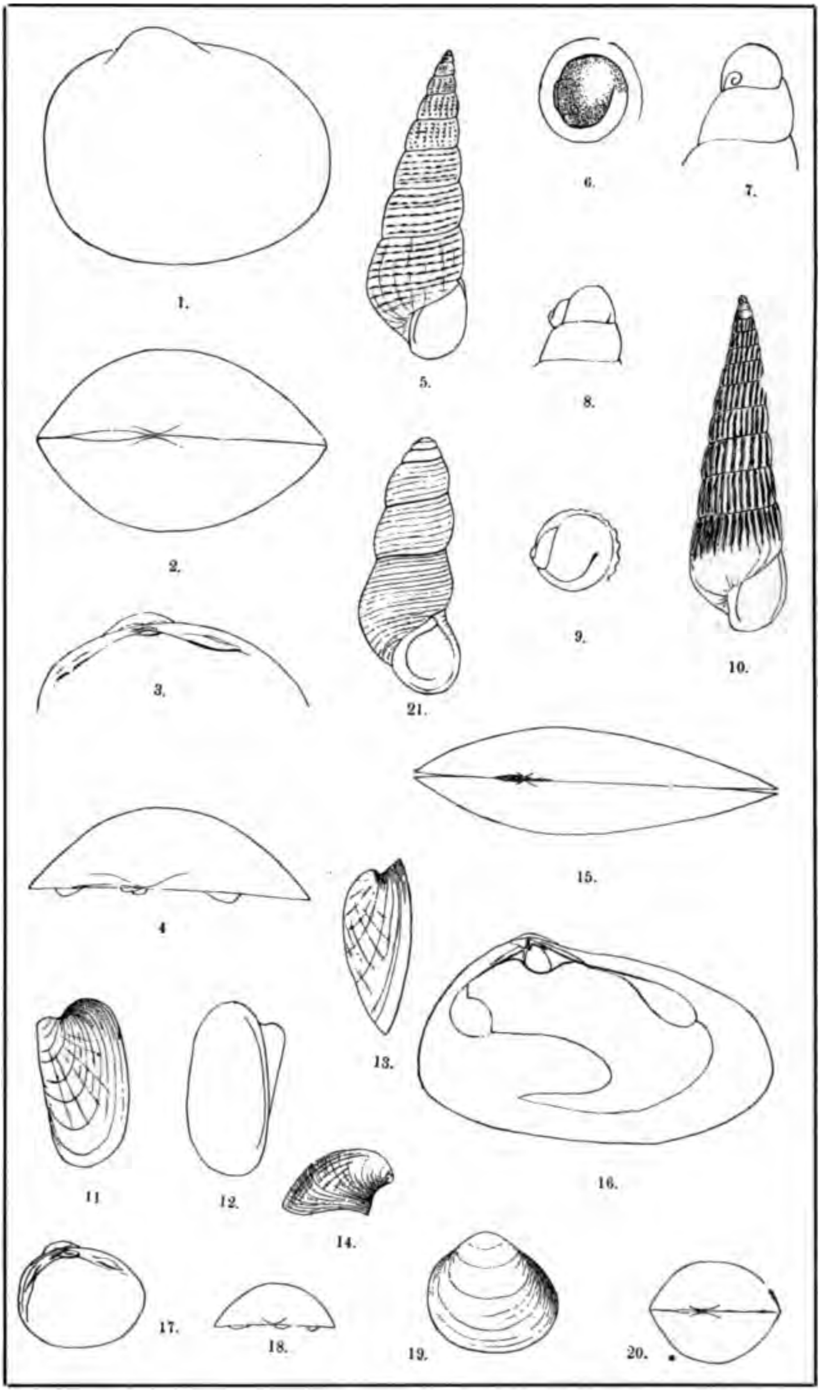


I. A. K. DEL.

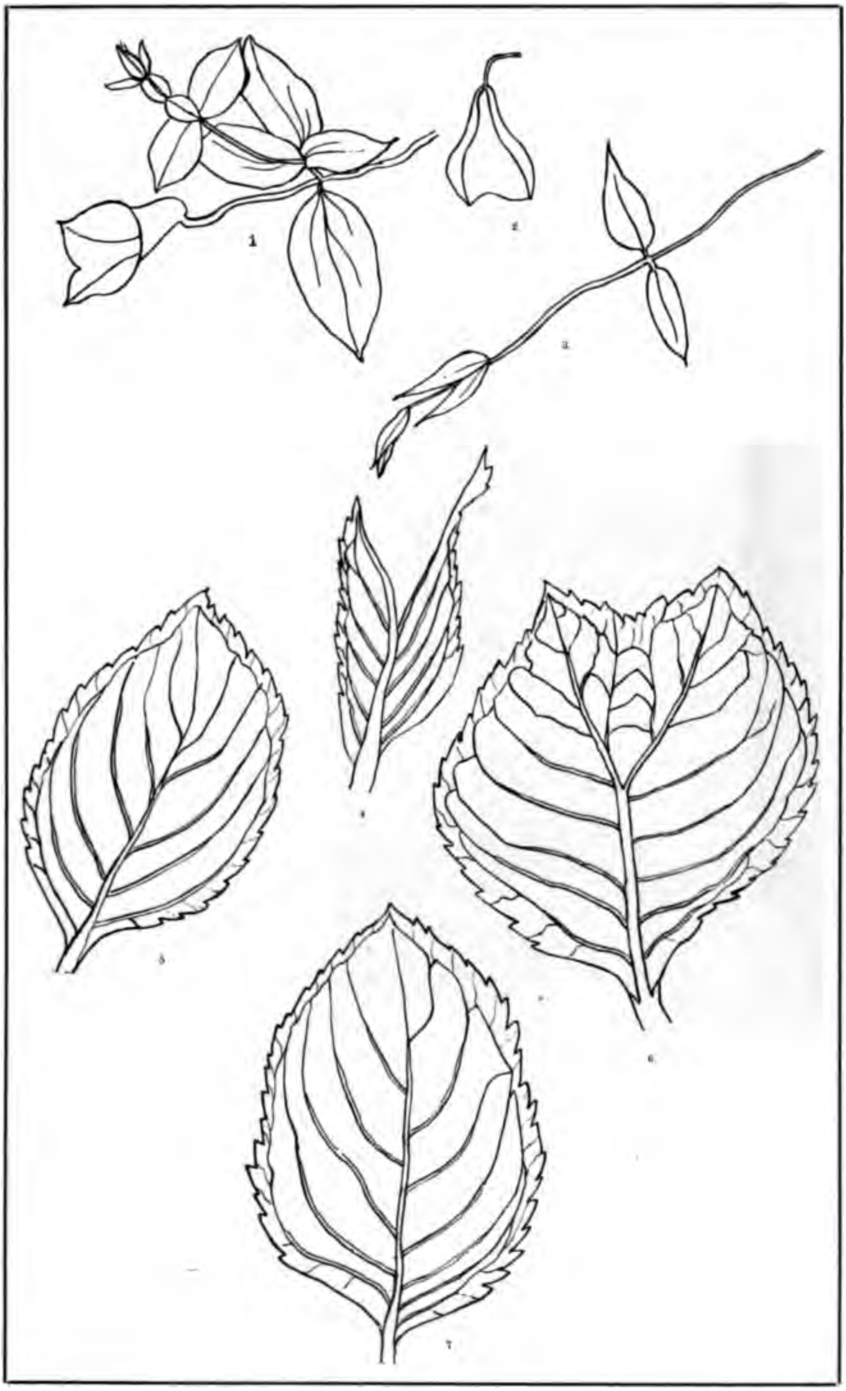
KELLER, UNDERGROUND RUNNERS.



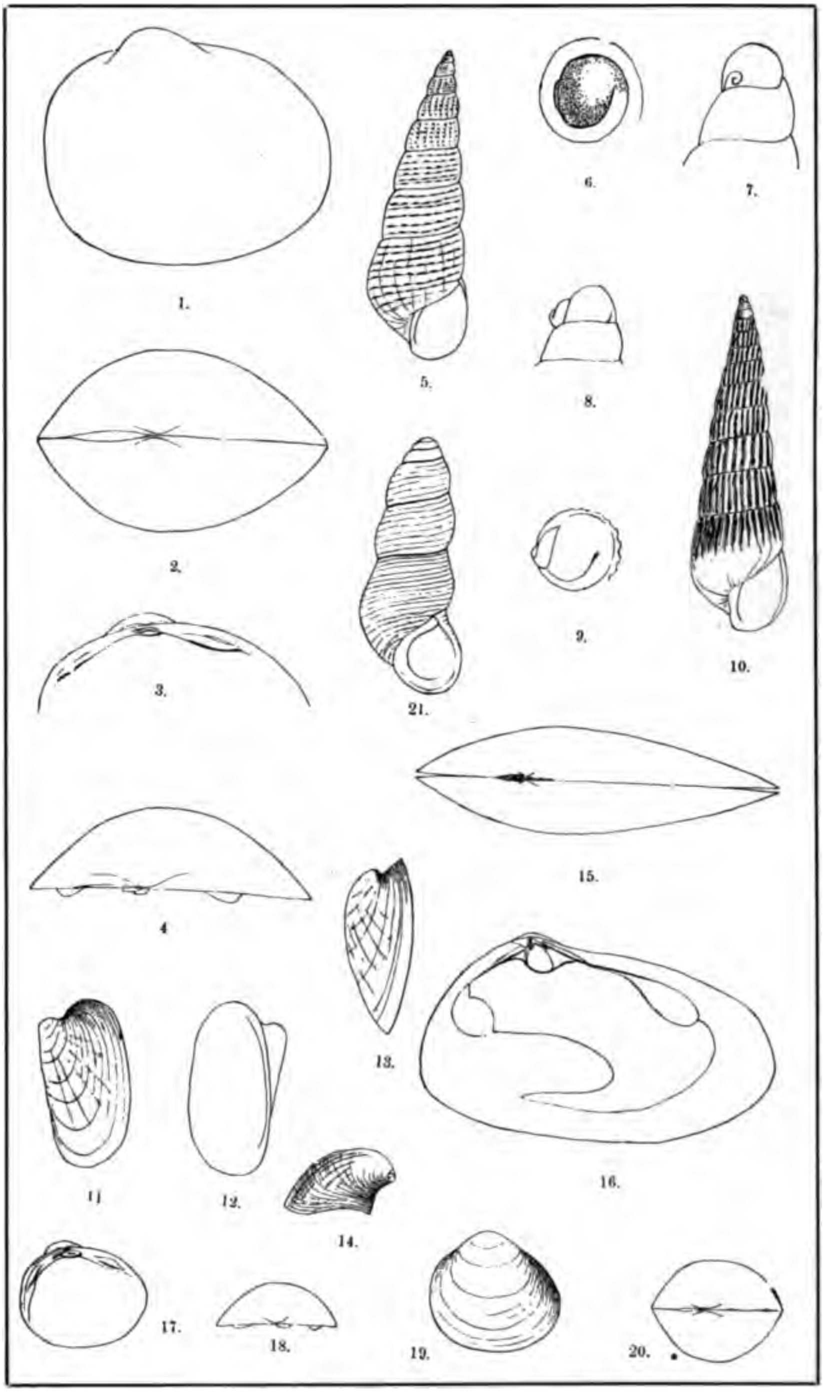
FOX. HYMENOPTERA OF BRAZIL.



PILSBRY. MOLLUSKS OF URUGUAY.



KELLER. PLANT MONSTROSITIES.



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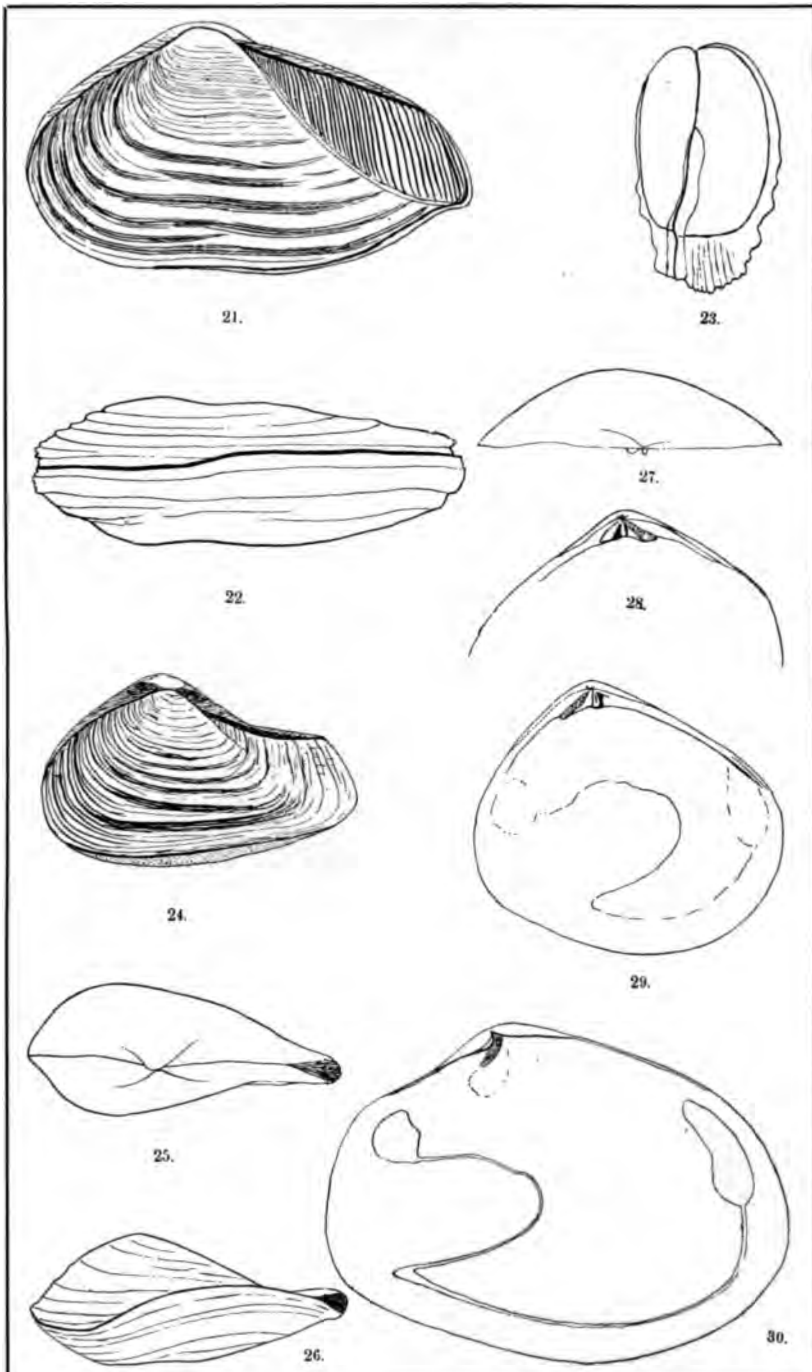
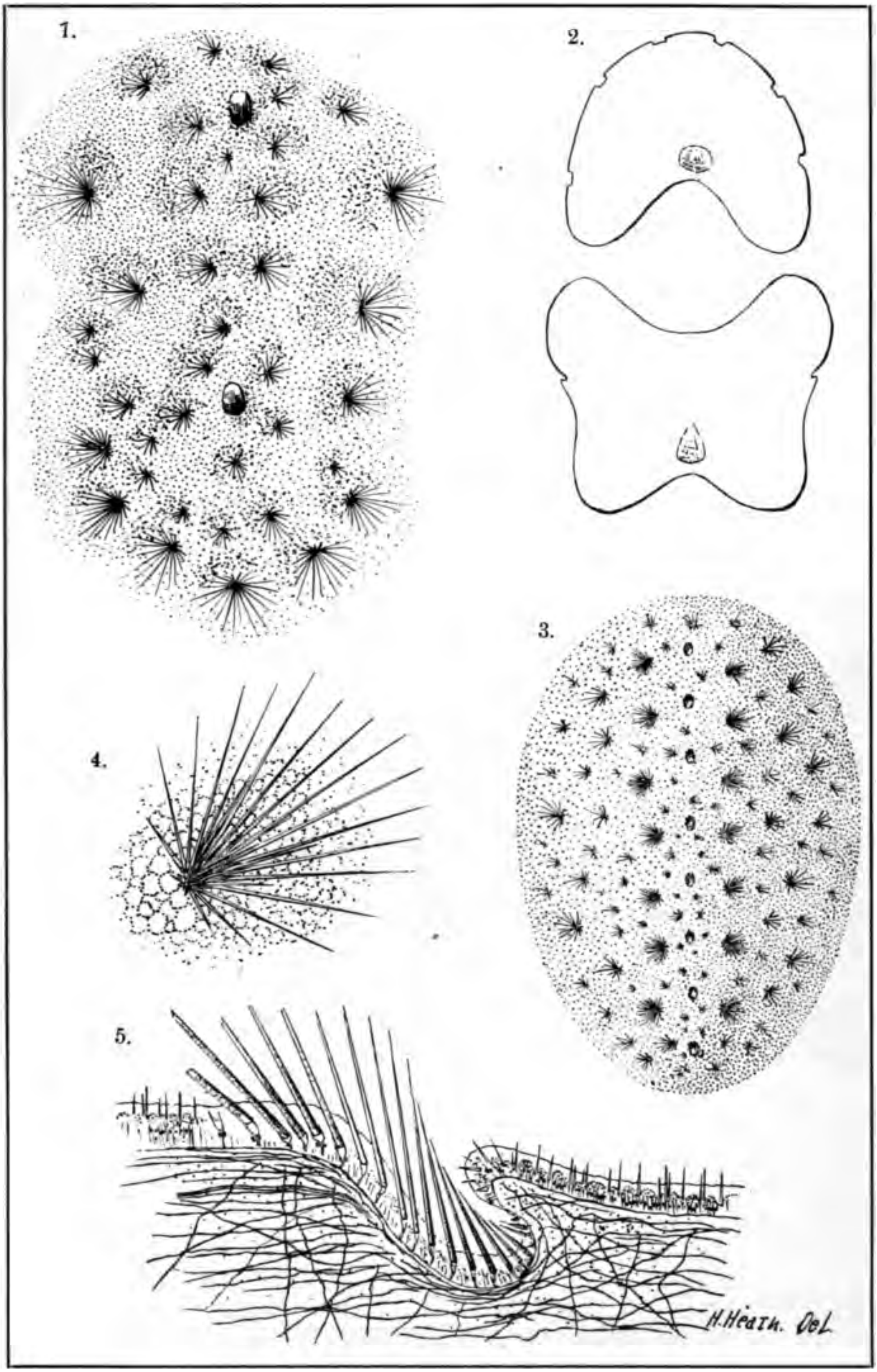
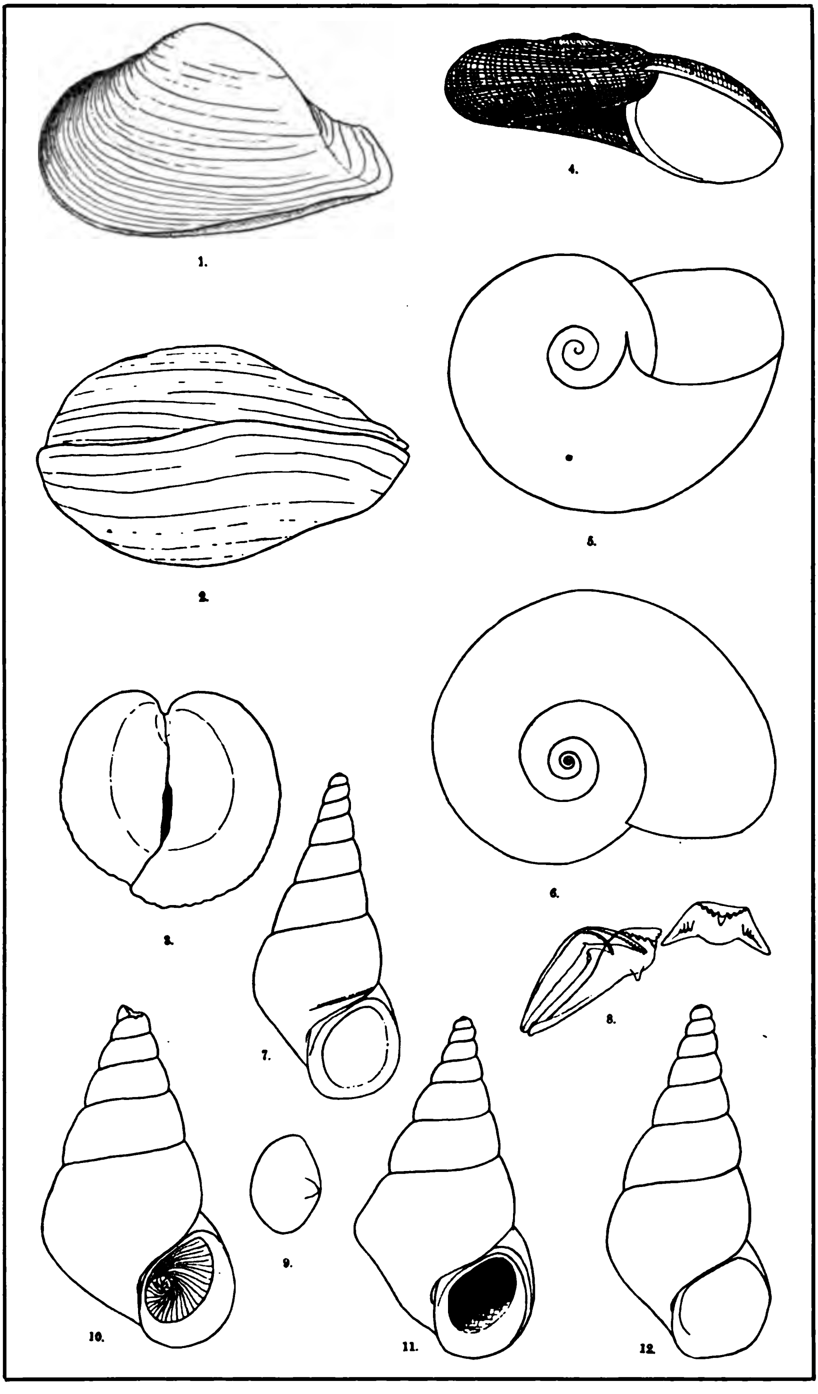


PILSBRY. MOLLUSKS OF URUGUAY.



HEATH ON CRYPTOCHITON.



PILSBRY. NEW AUSTRALIAN MOLLUSKS.

PILSBRY AND SHARP, SCAPHOPODA OF SAN DOMINGO.

RHOADS ON AMERICAN BOVIDÆ.

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PROCEEDINGS

OF THE

Academy of Natural Sciences

OF

PHILADELPHIA

1897.

PART I, JANUARY, FEBRUARY and MARCH,

EDITOR: EDWARD J. NOLAN, M. D.

PHILADELPHIA:

ACADEMY OF NATURAL SCIENCES,

LOGAN SQUARE.

1897.

Ten volumes of the New Series of the Journal (Quarto) have been issued
1896. The price per volume of four parts is $10, or $3 per part to subscribers, and
$12.50 per volume, or $3.75 per part. Vol. VII contains "The Extinct Mammalia
of Dakota and Nebraska, with a Synopsis of the Mammalian Remains of North A
Illustrated with thirty plates. By Joseph Leidy, M. D., LL. D.

The First Series of the Journal, 1817 to 1842, in eight volumes octavo,
obtained at $10 to members, and to the public, $15.

The First Series of the Proceedings of the Academy, published in octavo,
1843, of which eight volumes were completed Dec. 31, 1856, may be obtained at $2
bers, and to the public, $30.

The Second Series of the Proceedings, commencing January 1, 1857 (
fourteen volumes were completed Dec. 31, 1870), may be obtained at $42 to membe
per volume separately; and to the public $3.75 per volume.

The Third Series of the Proceedings, illustrated, commencing January 1,
which twenty-six volumes were completed Dec. 31, 1896), is published at $5 per
subscribers, payable in advance; single volumes, $6.25.

American Journal of Conchology, 1865-71. Seven vols., 8 vo. Containi
pages, illustrated by one hundred and fifty plates, many of them colored, besides
thousand wood engravings. Published at $70. Price reduced to $40 for the set.
volumes, $10 each.

BOOKS FOR SALE.

The Academy has the following works for sale at the prices affixed.

Description of Shells of North America, with 68 colored plates. By Thom
1830-34. $10.50.

Monograph of the Terrestrial Mollusca of the United States. With illustr
all the species. By Geo. W. Tryon, Jr. Fine edition, plate paper, with d
plates, colored and tinted, $20; colored edition, $15.00; plain edition, $8.50,
one hundred copies printed, which have been mostly sold.

Monograph of the Fresh Water Univalve Mollusca of the United States.
Haldeman, 1840-44. With Continuation to 1871. By Geo. W. Tryon, Jr.
with many colored plates. Fine edition, duplicate plates, $40; with colore
$25; with plain plates, $18.

Either the original work or the continuation furnished separately, if desired.

Synopsis of the Species of Strepomatidae (Melanians) of the United States.
W. Tryon, Jr. Cloth, $2; paper, $1.75.

List of American Writers on Recent Conchology, with the Titles of the Memoirs a
of Publication. By Geo. W. Tryon, Jr. Cloth, $2; paper, $1.75.

Monograph of the Order Pholadacea and other Papers. By Geo. W. Tryon, Jr.
$2; paper, $1.75.

Complete Writings on Recent and Fossil Conchology of C. S. Rafinesque. E
Wm. G. Binney and G. W. Tryon, Jr. $2.50.

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PROCEEDINGS

OF THE

Academy of Natural Sciences

OF

PHILADELPHIA

1897.

PART III, OCTOBER—DECEMBER.

PUBLICATION COMMITTEE.

THOMAS MEEHAN, CHARLES E. SMITH,
EDW. J. NOLAN, M. D., GEORGE H. HORN, M. D.,
HENRY SKINNER, M. D.

EDITOR: EDWARD J. NOLAN, M. D.

PHILADELPHIA:
ACADEMY OF NATURAL SCIENCES,
LOGAN SQUARE.
1898.

PUBLICATIONS OF THE
ACADEMY OF NATURAL SCIENCES
OF PHILADELPHIA.

Ten volumes and Volume XI, part 1, of the New Series of the JOURNAL (Quarto) have been issued—1847 to 1897. The price per volume of four parts is $10, or $3 per part to subscribers, and to others $12.50 per volume, or $3.75 per part. Vol. VII contains "The Extinct Mammalian Fauna of Dakota and Nebraska, with a Synopsis of the Mammalian Remains of North America." Illustrated with thirty plates. By JOSEPH LEIDY, M. D., LL.D.

The FIRST SERIES OF THE JOURNAL, 1817 to 1842, in eight volumes octavo, may be obtained at $40 to members, and to the public, $48.

The FIRST SERIES OF THE PROCEEDINGS of the Academy, published in octavo, 1841 to 1856, of which eight volumes were completed Dec. 31, 1856, may be obtained at $24 to members, and to the public, $36.

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